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SARGENTIA

A CONTINUATION OF THE
CONTRIBUTIONS FROM THE ARNOLD ARBORETUM
OF HARVARD UNIVERSITY

VII

THE FAMILIES ILLICIACEAE AND SCHISANDRACEAE

BY

A. C. SMITH

WITH FORTY-ONE TEXT-FIGURES

PUBLISHED BY
THE ARNOLD ARBORETUM OF HARVARD UNIVERSITY
JAMAICA PLAIN, MASS., U. S. A.
1947

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TABLE OF CONTENTS

Page
Introduction 1
Composition and relationships of the families 1
Geographical distribution 3
Sources of material 5
Acknowledgments 6
Illiciaceae
History 6
Local names and uses 7
Taxonomic treatment 8
Excluded entities 78
Insufficiently known entities 78
Schisandraceae
History 79
Local names and uses 81
Taxonomic treatment 81
Entities excluded from the Schisandraceae 208
Insufficiently known entities in the Schisandraceae 209
Bibliography 209
List of cited specimens 211

INTRODUCTION

In recent years the writer has collaborated with Prof. I. W. Bailey and Dr. Charlotte G. Nast in studies of woody ranalian families, in an attempt to correlate the anatomy and morphology of these groups with the taxonomy (see papers in bibliography numbered 1–9, 30–32, 36–40). In selecting the genera *Illicium, Schisandra,* and *Kadsura* for our next studies, we turn to a very important group of ranalian genera—important for the primitive aspects of certain of its organs and also for the implications of its distributional patterns. It is hoped that a study of these genera will add to our knowledge of the relationships of ranalian plants. The present paper is directed toward a systematic revision of the Illiciaceae and Schisandraceae, which may serve as a framework for subsequent morphological and anatomical studies by Prof. Bailey and Dr. Nast.

COMPOSITION AND RELATIONSHIPS OF THE FAMILIES

Illicium, Schisandra, and *Kadsura* make up a very compact group within the Ranales, all three genera being characterized by having tricolpate or derived types of pollen and secretory cells of the ranalian type; otherwise this combination occurs only in the Tetracentraceae (Bailey & Nast, 2: 341). It has long been realized by systematists who have looked into the matter that these three genera have no close affinity to the Magnoliaceae (e. g. Dandy, 15; Bailey & Smith, 9: 356). On the basis of various morphological and anatomical characters, the Magnoliaceae form with their only close allies, the Himantandraceae and De-

generiaceae, a compact group of families. In general usage at present is the family name Schisandraceae, usually taken to include *Schisandra* and *Kadsura,* but most students fail to consider the proximity of the genus *Illicium* to this family. On the other hand, *Illicium* in most recent discussions is referred to the Winteraceae, with which group it has very little in common other than the broadest ranalian characters (e. g. van Tieghem, 42: 349–354; Bailey & Nast, 6: 41–42).

Illicium, as will be shown in the detailed morphological consideration by Bailey & Nast which will follow the present treatment, has no close allies other than *Schisandra* and *Kadsura.* The three genera will probably be treated by future phylogenists as composing a suborder of the Ranales, coördinate with suborders composed of the (1) Magnoliaceae, Himantandraceae, and Degeneriaceae, (2) Winteraceae, (3) Trochodendraceae and Tetracentraceae, (4) Eupteleaceae, and other combinations of families which we have not yet sufficiently investigated. For these suborders we refrain from proposing formal names, where none already exist, since it appears that such proposals should follow rather than precede intensive study of the entire order.

As regards the systematic position of *Illicium,* the only question to be considered is whether or not the genus may be placed in the Schisandraceae. As a result of our collaborative studies of the three genera concerned, my colleagues and I have concluded to keep *Illicium* apart in a separate family, the Illiciaceae. In degree of relationship, *Illicium* seems somewhat more distinct from the Schisandraceae than does, for instance, *Tetracentron* from the Trochodendraceae (7, 31, 39). The principal distinctions between the Illiciaceae and the Schisandraceae may be summarized as follows:

Shrubs or small trees with hermaphrodite flowers; leaf-blades often pseudoverticillate at distal nodes of branchlets, often coriaceous, entire-margined; flowers with a convex or short-conical torus terminating in an inconspicuous sterile extension, the torus not much modified in fruit; stamens free, in one to several series; carpels comparatively few (7–15, rarely 5–21), in a single whorl around the minute toral extension, composed of a laterally flattened ovary distally attenuate into an obvious style, this vascularized, conduplicate, and ventrally stigmatic; ovule single, borne ventrally near base; fruit a follicetum composed of a single whorl of free spreading follicles, these dehiscing ventrally, 1-seeded; seed ellipsoid or obovoid and laterally flattened, with a subbasal hilum, the testa smooth and shining ..... ILLICIACEAE.

Dioecious or monoecious woody vines; leaf-blades usually obviously alternate, sometimes comparatively thin in texture, entire or toothed; flowers with a variously shaped torus, at least the ♀ ones without a sterile extension, the torus of ♀ flowers greatly modified in fruit, elongate or capitate; stamens free or variously aggregated; carpels comparatively numerous (12–300), several- to many-seriate, sporophyll-like, conduplicate, with two closely approximated stigmatic crests extending along part of the ventral edge, these crests usually distally continued into a pseudostyle, which is essentially unvascularized; ovules 2 to several, ventrally attached or pendulous; fruit aggregate, baccate, composed of a modified torus and indehiscent drupe-like carpels; seeds most often 2 (sometimes more, occasionally 1), immersed in the fleshy pulp of the pericarp, usually ellipsoid-subreniform, with a ventral or superior hilum, the testa smooth to rugulose-tuberculate ..... SCHISANDRACEAE.

A cursory examination of the preceding comparison will at once disclose several primary points of divergence. Differences pertaining to the habit, the hermaphrodite vs. unisexual flowers, the toral development after anthesis, the carpel-arrangement, the presence or absence of a vascularized style, the fruit-type, and the seed-shape and hilar position seem jointly to indicate family status for the two groups. Further amplification of the morphological and anatomical charac-

ters by my colleagues will, it is hoped, convince the most conservative reader that the *Illiciaceae* merit family rank.

An interesting, but perhaps fruitless, speculation may be developed as to which is the more primitive group, the Illiciaceae or Schisandraceae. Palaeobotanical evidence does not help us reach a conclusion, nor does modern distribution, which is essentially similar in the two groups. The Illiciaceae in their habit and their hermaphrodite flowers have characteristics usually deemed primitive, but in their highly specialized carpels with vascularized styles they are comparatively advanced. The Schisandraceae seem comparatively primitive in their carpels, which are sporophyll-like and suggestive of the Winteraceae or Degeneriaceae in general type, but in having a scandent habit, unisexual flowers, and a remarkably modified torus they seem less primitive than the Illiciaceae. We thus see that the two groups, doubtless derivatives from the same ancestral stock, have become specialized in different ways and have each retained certain primitive characteristics. To say that one is more primitive than the other seems impossible.

GEOGRAPHICAL DISTRIBUTION

Occurring throughout a fairly extensive area in southeastern Asia and in a more limited region in southeastern North America (see maps, *figs. 1* and *2*), the Illiciaceae and Schisandraceae are classic examples of the occurrence of coherent groups in the southeastern portions of both parts of the Northern Hemisphere. The Winteraceae, on the other hand, show a diametrically opposite type of distribution, which I have already detailed (38); the latter family is one of the best illustrations of bicentric palaeoantarctic distribution. If any psychological impetus be needed, in addition to that furnished by the striking anatomical and morphological dissimilarities, to convince students of the distinctness in phylogenetic history of *Illicium* and the Winteraceae, a study of their distributions should provide it.

The early papers of Asa Gray (19, 20, 21) discussing and explaining the distribution of similar elements in eastern Asia and eastern North America are known to all taxonomists. The problems pertaining to this fairly common type of plant distribution have been repeatedly and competently discussed in modern times, and the interested reader will be aware of such summarizing papers as those of Sargent (35), Fernald (17), and Hu (23, 24). The present work is not the place, nor has the present writer the ability, to amplify the excellent discussions which are already available concerning this problem.

Because the Illiciaceae and Schisandraceae are so well represented in China, reference may be made to the map showing phytogeographic divisions in that country which accompanies Li's study (27). An east-west line on this map accurately delimits the northern boundary of the Illiciaceae in continental Asia, approximately following the northern edges of the following regions proposed by Li: eastern China maritime region, middle lake region, upper Yangtze region, and Sino-Himalayan region. The Schisandraceae, however, extend farther north in Asia, into Li's northeastern Chinese and Korean region and northern China plain region.

As elsewhere stated in this treatment, *Illicium* is sharply divisible into two sections, § *Badiana* and § *Cymbostemon*. It is noteworthy that both sections occur in both hemispheres, a situation which is not always paralleled in genera of this distribution. In *Schisandra,* for instance, only one section (§ *Euschi-*

sandra) now occurs in America. This persistence of both sections in both regions may indicate only that *Illicium* succeeded in migrating somewhat farther south in America than did certain other genera, and that consequently the survival of both taxonomic sections was possible. On the other hand, it may have been purely fortuitous that both sections of *Illicium* succeeded in migrating to the Western Hemisphere (assuming the origin of the genus to have been Asiatic). In *Schisandra,* where only one section of four now occurs in America, we may assume either (1) that the other three sections once occurred in America but have now become extinct, or (2) that only one of the four sections succeeded in reaching America in the original migration. If the latter is true, an Asiatic origin would be indicated for *Schisandra;* it seems entirely likely to the present writer that both *Schisandra* and *Illicium,* as well as the great majority of the other genera of this general distributional pattern, were Old World in origin.

Further to consider the probable place of origin of these two families, it should be noted that the two hypothetically primitive sections of the Schisandraceae, § *Pleiostema* (of *Schisandra*) and § *Cosbaea* (of *Kadsura*), have an area of overlap in southern China and northern Indo-China. In this general area *Illicium*

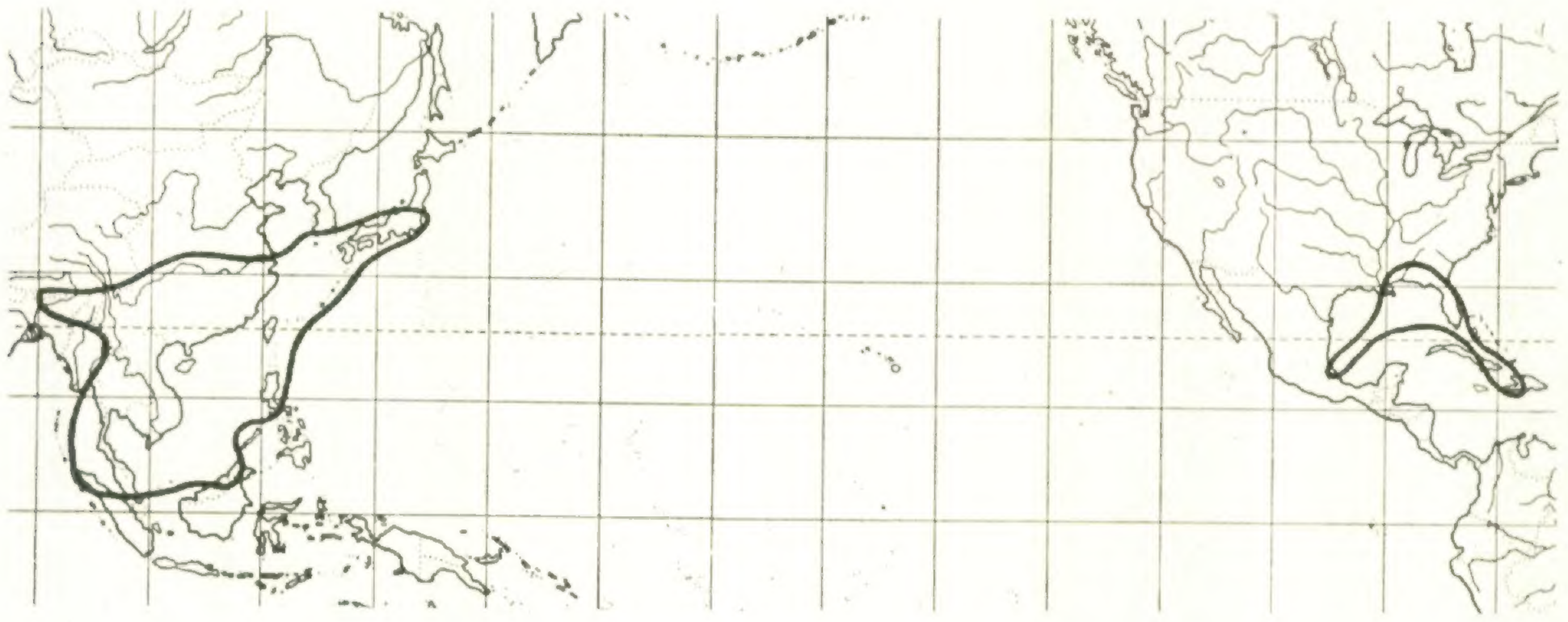

FIG. 1. Generalized distribution of *Illicium.*

also has its greatest concentration of species. It seems to the writer that thus far no very convincing evidence has ever been presented, on the basis of morphology, genetics, modern distribution, or even palaeobotany, to indicate that any existing family of the woody Ranales was northern rather than tropical in origin.

In citing specimens, I have listed them in general from north to south. It has not always been possible to find the localities mentioned by collectors, but as far as feasible I have done this and have mapped the distribution of each species. Rather than follow the varied spellings offered by various collectors, I have attempted to make uniform my mention of geographical names. Standard atlases have been consulted, and a few of the more specialized publications which have been followed for spelling, when possible, are here listed:

For Japan: S. Gerr, A gazetteer of Japanese place names. 1942.

For China: Gazetteer of Chinese place names (published by Army Map Service, U. S. War Department, 1944). [Names in this gazetteer are romanized according to a modified Wade-Giles system adopted as a standard by the Board of Geographic Names; the gazetteer is based on the V. K. Ting Atlas of China.]

For India and Burma: The imperial gazetteer of India (Atlas, vol. 26, revised. 1931).

For Indo-China: Atlas des colonies françaises. 1934.

For Dutch possessions: Atlas von tropisch Nederland. 1938.

SOURCES OF MATERIAL

This treatment is based entirely upon herbarium material, and I am greatly indebted to the directors and curators of the various institutions from which specimens were loaned. I particularly appreciate the kindness of Sir Edward Salisbury, Director, and Dr. W. B. Turrill, Keeper, in trusting the invaluable Kew material to transatlantic parcel post; an adequate understanding of certain Indian and Malayan elements would not have been possible without this Kew loan. Following are the herbarium abbreviations used throughout this work:

A: Arnold Arboretum, Harvard University.
Ch: Chicago Natural History Museum.
GH: Gray Herbarium, Harvard University.
K: Royal Botanic Gardens, Kew.
M: Missouri Botanical Garden.
Man: Bureau of Science, Manila.[1]
NY: New York Botanical Garden.
UC: University of California, Berkeley.
US: U. S. National Herbarium.

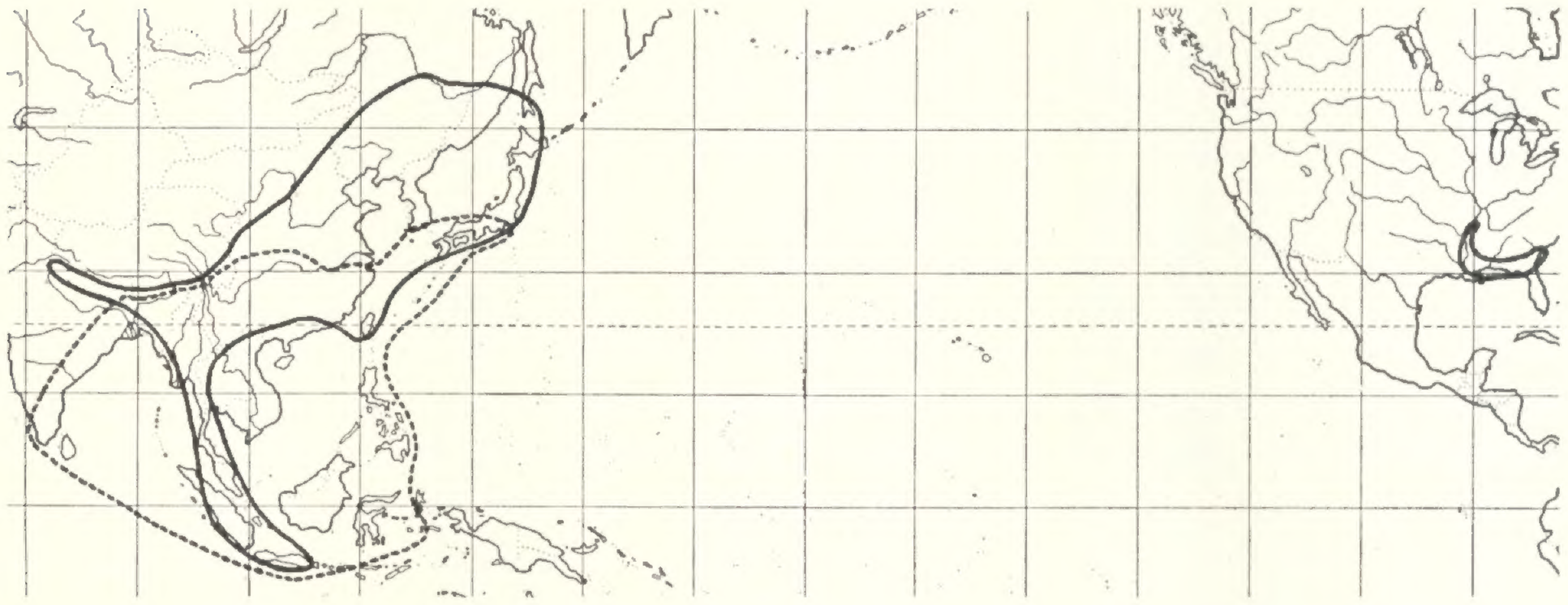

FIG. 2. Generalized distribution of the genera of Schisandraceae: *Schisandra,* solid line; *Kadsura,* broken line.

The writer is fortunate in having been able to assemble for direct comparison a great bulk of material, including types or type duplicates of nearly every entity, together with a considerable number of recently collected specimens from previously neglected areas. The herbarium of the Arnold Arboretum, with its ample accessions from recent Chinese collectors, makes possible an understanding of entities which have previously been inadequately represented.

The literature pertaining to *Illicium, Schisandra,* and *Kadsura* is voluminous and extremely scattered, but an attempt has been made to examine and evaluate the major part of it as this applies to the taxonomy of the genera. In the course of this study about 400 separate works have been examined, and most of these will be found cited in the synonymy. Certain references are too inadequate or too garbled to be of any value in taxonomic work and these have been omitted.

[1] A limited number of specimens, principally Chinese, were loaned to Dr. E. D. Merrill some years ago from Manila to facilitate his work; these specimens are now in storage at the Arnold Arboretum, and they may represent all that remains undestroyed of the Manila plant collections.

The horticultural references, as far as possible, have been included when reasonable certainty exists as to the identity of the plants discussed. Many pharmaceutical references have been omitted as beyond the scope of the present paper; most of these references pertain to *Illicium verum.*

However, every attempt has been made to include all post-Linnaean scientific names—and as many pre-Linnaean names as possible—in the synonymy, and it is hoped that no serious omissions will be found in this respect. The major part of the illustrations listed in Index Londonensis have been examined and evaluated, and those deemed worthy of inclusion in a taxonomic treatment will be found listed chronologically in the synonymy; illustrations are not listed separately.

Local names are included sparingly, since for many species these are recorded at great length by other writers. Some of the species have innumerable local names, but it seems impossible to check the validity of these and inadvisable to list all the variant spellings in a work of this sort. Therefore only the common names most often found in the literature, or attested to by reliable modern collectors, are here included. Chinese and Japanese common names, except as they are known and used in translation, are perforce omitted.

ACKNOWLEDGMENTS

Throughout the progress of this study, the writer has enjoyed the intimate collaboration of Prof. I. W. Bailey and Dr. Charlotte G. Nast, who have contributed greatly to the solution of various taxonomic puzzles; conclusions expressed in this paper, however, are the sole responsibility of the author. Prof. E. D. Merrill and Prof. Alfred Rehder have given welcome advice on questions pertaining to nomenclature, distributional problems, etc. I am indebted to Dr. J. F. Rock for assistance in deciphering certain Chinese herbarium labels and for suggestions pertaining to the orthography of Chinese place-names. The base-maps used throughout this paper are taken from Goode's Series of Base Maps (University of Chicago Press), with the exception of *figs. 8* and *26,* the base maps for which are used by courtesy of the U. S. Department of Agriculture. The drawings here published as text-figures have been made by Mr. Gordon W. Dillon.

ILLICIACEAE

History

The first mention, in European literature, of any plant referable to the group here circumscribed as the Illiciaceae was by Clusius (14), who, in 1601, described as *Anisum philippinarum insularum* a fruit which had reached him from the Philippines. Subsequent research has indicated that this fruit did not represent a Philippine species, but was rather from the species now known as *Illicium verum,* the fruits of which early found their way to the Philippines from southern China as an article of commerce. Apparently Cavendish took these fruits from the Philippines to Europe in 1587 (see Robinson in Philip. Jour. Sci. Bot. **3**: 305. 1908). Bauhin (11), in 1650, described the fruits of *I. verum* as *Zingi fructus stellatus.* . . . It is quite understandable that *I. verum,* as the only species of the genus with any consequential economic value, should have been the first representative of the group known to Europeans. A further important pre-Linnaean reference is Kaempfer's work Amoenitatum Exoticarum (25), of 1712, in which are described species which serve as the bases of the modern genera *Illicium* and *Kadsura.*

Linnaeus himself, in 1749 (Materia Medica 180), briefly discussed an entity of assumed medicinal value under the name *Badianifera,* this entity doubtless having been based on the fruits of *I. verum. Badianifera,* however, was not mentioned in Species Plantarum, and for the first valid publication of a generic name for the group we pass on to 1759, when Linnaeus (Syst. Nat. ed. 10. 1050) described *Illicium* and proposed the binomial *I. anisatum,* basing the latter entirely upon Kaempfer's *Somo, vulgò Skimmi.* . . . For further discussions of the early synonymy applicable to entities under *Illicium,* the reader is referred to the taxonomic portion of this treatment, under *I. anisatum* and *I. verum.* Linnaeus obviously derived his generic name from the Latin *illicere,* to allure, in reference to the pleasant fragrance of the fruits of *I. verum.* The distinction between this economically useful product (of *I. verum*) and the poisonous seeds of *I. anisatum* was not made until long after Linnaeus' time, and a certain confusion between the two entities has persisted in taxonomic literature. However, no serious problems of nomenclature are concerned.

It is not advisable in this treatment to trace the numerous discussions of the species of *Illicium* since Linnaeus, since most references will be found cited in the pertinent synonymy. It will suffice to mention a few treatments in which some comprehensive view of the genus was adopted. Maximowicz (28), in 1888, presented a key to the eight species known to him. King (26), in his study of Indian Magnoliaceae of 1891, described and keyed the five species of *Illicium* known to him from the region. Van Tieghem's classic work (42) of 1900 includes a section discussing *Illicium,* although not from a taxonomic point of view, which is of great importance for any study of the genus; the aspects of this work which are related to nomenclature will be discussed following the synonymy of the family name, below. In 1905 Finet & Gagnepain (18), discussing *Illicium* in eastern Asia, offered a key to seven species. Nakai's work (29) of 1933, although too limited geographically to be of great significance to a student of *Illicium,* is remarkable for the care exercised in assembling its valuable bibliography. In 1940 Hoh (22) published a highly interesting treatment of the commercial star anise (*I. verum*) which excellently summarizes our knowledge of the only commercially important species of the group. In the most recent attempt to present a classification of *Illicium,* Wu (44) in 1940 has published a key to the 10 species believed by him to occur in southern China.

From the preceding paragraph it will be seen that the genus *Illicium* has yet to receive a comprehensive taxonomic treatment, although it has been included in numerous floristic works. Estimates as to the size of the genus appear to me altogether too conservative; in the present treatment I account for 42 species, several of which are further subdivided. Many of these species are new, being based on recently assembled material; in *Illicium,* as in most groups which are well represented in southern China, collections made during the past two decades by Chinese collectors have greatly amplified our knowledge and have resulted in the discovery of entities hitherto unsuspected.

Local names and uses

Most collectors have failed to indicate local names for specimens of *Illicium,* but whenever these are available and seem reliable they are listed by me under each species. In a general way, the name *star anise* was used by early writers in English as synonymous with *Illicium;* similarly the French used *anis étoilé,* and the Germans *Sternanis.* These names are probably more strictly to be limited to

Illicium verum. The French *badianier*, and to a lesser extent the English *badian*, or variants, are perhaps more to be taken as common generic names, although here too the implication is often to the commercial species.

In *Illicium* only *I. verum*, which provides a volatile oil of commercial value, is of economic consequence. The seeds of *I. anisatum* are known to be poisonous, and this species has certain very local and limited uses. A few species of southern China are reported to have edible seeds. Such uses as have been recorded are briefly mentioned under the various species in this treatment.

Taxonomic treatment

Illiciaceae fam. nov.

Tulipiferae Vent. Tabl. Reg. Vég. **3:** 68, quoad *Illicium*. 1799.

Wintereae R. Br. ex DC. Reg. Veg. Syst. Nat. **1:** 548, quoad *Illicium*. 1817; Lindl. Introd. Nat. Syst. Bot. 26, p. p. 1830.

Magnoliaceae trib. *Illicieae* DC. Prodr. **1:** 77, quoad *Illicium*. 1824; Dumort. Anal. Fam. Pl. 50, p. p. 1829; G. Don, Gen. Syst. **1:** 78, p. p. 1831; Torr. & Gray, Fl. N. Am. **1:** 42. 1838; Walp. Rep. Bot. Syst. **1:** 72, p. p. 1842, **2:** 14, p. p. 1845; Brongn. Enum. Gen. Pl. 96, p. p. 1843; Walp. Ann. Bot. **4:** 42, p. p. 1857; Le Maout & Dec. Traité Gén. Bot. 383, p. p. 1878; Matsuda in Jour. Coll. Sci. Tokyo **6:** 124, p. p. 1893.

Ranunculaceae B. *Dillenieae* a. *Illicieae* Reichenb. Consp. 192, quoad *Illicium*. 1828.

Magnoliaceae B. *Illicica* Bartling, Ord. Nat. Pl. 249, quoad *Illicium*. 1830.

Winteraceae Lindl. Nat. Syst. Bot. ed. 2. 17, quoad *Illicium*. 1836; Loudon, Arb. et Frut. Brit. **1:** 256, p. p. 1838; sensu Ridley, Fl. Malay Penins. **1:** 18. 1922.

Magnoliaceae trib. *Wintereae* R. Br. ex Meissn. Pl. Vasc. Gen. 3, quoad *Illicium*. 1836, pars alt. 5, p. p. 1843; sensu Hook. f. & Thoms. Fl. Ind. **1:** 73. 1855; Benth. & Hook. f. Gen. Pl. **1:** 17, p. p. 1862; Walp. Ann. Bot. **7:** 46, p. p. 1868; sensu Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1:** 39. 1872; Hemsl. in Garden **8:** 270, p. p. 1875; sensu A. Gray, Syn. Fl. N. Am. **1:** 58. 1895; Nakai, Fl. Sylv. Koreana **20:** 110, p. p. 1933.

Ranunculaceae 3. *Magnolieae* b. *Illicieae* α. *Illicieae genuinae* Reichenb. Handb. Nat. Pfl. 278. 1837.

Magnoliaceae subord. *Illicieae* DC. ex Endl. Gen. Pl. 838, quoad *Illicium*. 1839, Enchir. Bot. 428, p. p. 1841.

Magnoliaceae trib. *Illicieae* sect. *Illicineae* Spach, Hist. Nat. Veg. **7:** 439. 1839.

Magnoliacées trib. *Illiciées* A. Juss. in Orbigny, Dict. Univ. Hist. Nat. **7:** 589, p. p. 1846.

Paeoniaceae c. *Dillenieae, Illicicae* Horaninow, Tetract. Nat. 31 (p. p.?). 1843.

Paeoniaceae trib. *Dilleniariae* c. *Illicieae* Horaninow, Char. Ess. Fam. Reg. Veg. 175, quoad *Illicium*. 1847.

Magnoliaceae II. *Wintereae* Lindl. Veg. Kingd. ed. 2. 419, quoad *Illicium*. 1847.

Magnoliaceae subord. *Wintereae* A. Gray, Gen. Pl. U. S. **1:** 54, quoad *Illicium*. 1849; sensu Chapman, Fl. Southern U. S. 12. 1860.

Magnoliacées ser. *Illicieae* Baill. Hist. Pl. **1:** 189, quoad *Illicium*. 1868–69.

Magnoliaceae II. *Illicieae* Luerssen, Grundzüge Bot. 343, quoad *Illicium*. 1877.

Magnoliaceae II. *Wintereae* (*Illicieae*) Eichl. Blüthendiagr. **2:** 150, quoad *Illicium*. 1878.

Magnoliaceae III. *Illicieae* Prantl in E. & P. Nat. Pfl. III. **2:** 18, quoad *Illicium*. 1888; Dalla Torre & Harms, Gen. Siphon. 171, p. p. 1901.

Magnoliaceae trib. *Winteriae* sensu King in Ann. Bot. Gard. Calcutta **3:** 199. 1891.

Magnoliaceae Unterfam. *Illicieae* sensu Dippel, Handb. Laubholzk. **3:** 157. 1893; Karsten, Fl. Deutsch. **2:** 112, quoad *Illicium*. 1895; sensu Beissn., Schelle, & Zabel, Handb. Laubh.-Benen. 102. 1903.

Magnoliaceae III. *Illicioideae* Harms in Ber. Deutsch. Bot. Ges. **15:** 358. 1897.

Illiciacées v. Tiegh. in Jour. de Bot. **14:** 353. 1900.

Magnoliacées trib. *Wintérées* sensu Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 27. 1905 [repr. Contr. Fl. As. Or. **2:** 27. 1907].

Illiciaceae v. Tiegh. ex Pilger in E. & P. Nat. Pfl. Nachtr. **3:** 108, as synonym. 1906; Hu in Bull. Chin. Bot. Soc. **1:** 86, nomen subnudum. 1935.

Magnoliaceae subfam. *Illicioideae* Harms ex Rehner, Man. Cult. Trees and Shrubs ed. 2. 246. 1940.

Familia characteribus generis unici.

It seems remarkable that a group with such an involved synonymy as that indicated above should be in need of a new family name, but this appears to be the case. It is perhaps not necessary to go into the history of the numerous combinations and variations listed above, as most of these are self-explanatory. It is sufficient to mention that practically all of the early writers who concerned themselves with the grouping of genera into larger categories were satisfied to link *Illicium* with *Drimys*. This was due, needless to say, not to any conviction on the part of students, but primarily to inertia or to lack of original examination of material. To be sure, material of *Drimys* and its relatives has until recently been very sparse in herbaria, and the older writers may readily be excused for following one another in their classifications. Of the earlier writers, Reichenbach (in 1837) seems to have been the first to separate *Illicium* from *Drimys* in any degree, and even he used a quadrinomial expression to do so. Actually Spach (in 1839) was the first to make any satisfactory distinction, setting up a section for *Illicium* and *Cymbostemon* coördinate with a section for *Drimys,* both sections being grouped under the old concept *Magnoliaceae* trib. *Illicieae* of de Candolle. In more recent times Harms (in 1897) and Rehder (in 1940) have recognized *Illicium* alone as representing a subfamily of the Magnoliaceae.

Yet, in spite of this reluctance finally to separate *Illicium* from the Winteraceae, there appear to be no grounds whatever for its inclusion in that family, a fact which has been remarked by Bailey & Nast (6: 41–43) and the writer (37: 120) and which does not call for amplification in the present treatment.

For the first clear statement positively separating *Illicium* from *Drimys* and its relatives we must turn again to the often cited work of van Tieghem, in which (42: 349–354) we find a section entitled "Comparaison de ces six genres avec le genre Badianier." In this discussion van Tieghem points out, at considerable length and with emphasis, the many reasons which forbid a linking of *Illicium* with *Drimys* and its relatives, summing up with: "Ces différences sont telles, si nombreuses et si grandes, qu'il n'est plus possible désormais de classer ce genre à côté des autres dans une même famille naturelle."

For *Illicium* van Tieghem suggested the new family Illiciacées in the following words: "Les Badianiers ne peuvent pas davantage être conservés, même comme tribu distincte, dans la famille des Magnoliacées. Il convient donc de les considérer comme le type d'une famille autonome et nouvelle, les *Illiciacées*. Je me propose de revenir prochainement, dans un travail spécial, sur les caractères et la composition de cette famille." The proposed publication was apparently not prepared, and as far as I can ascertain the quoted work is van Tieghem's only one on *Illicium*.

In certain other ranalian families which I have recently revised, it has seemed advisable to consider van Tieghem's publications of family names in French as establishing his authorship, and I have suggested the use of names such as Tetracentraceae v. Tiegh. ex A. C. Sm. (39: 135) and Eupteleaceae v. Tiegh. ex Hayata (40: 175). The name Illiciacées v. Tiegh. does not fall into the same category. In his treatments of both the Tetracentracées and the Euptéléacées, van Tieghem published actual revisions of the families and formally proposed the

family names, even though they do not strictly meet the requirements of the International Rules. For this reason I believe that he should be acknowledged as the author, even if not the actual publishing author according to strict interpretation of the Rules. The suggestion of the name Illiciacées, however, as shown by the above quotation, was provisional and was made only incidentally in separating *Illicium* from *Drimys* and its relatives. The paper in which this name was to have been formally proposed appears never to have been published. Under these circumstances, I prefer to propose the name Illiciaceae as new with the present treatment.

The preceding is not written in criticism of van Tieghem, who certainly had a much sounder understanding of the ranalian families than any of his contemporaries, as I have already remarked (39: 126–127). That such carefully presented studies as van Tieghem's cannot be considered as establishing family names, because these names are not proposed in a Latin form, is possibly regrettable. His method of treatment and presentation seems infinitely superior to that of many authors, even in the present time, whose proposals of new family names are acceptable because they meet with the letter of the International Rules; in some such cases the names have been proposed with fantastic inadequacy from every viewpoint except a purely legalistic one. Good taste alone should forbid any modern author from proposing such an important entity as a family name unless he accompanies it by a reasonably detailed study.

Pilger's use of the name Illiciaceae (in 1906) cited above is in the synonymy of Magnoliaceae and is made without comment, and so it cannot be considered valid publication. The validity of Hu's use of the name (in 1935) cited above is a debatable point. I quote Hu's discussion in full: "**Illiciaceae.**—This family is represented in both regions; with 9 species of *Illicium* in China, and 1 species in Southeastern North America." It is acknowledged that the family is perhaps circumscribed by this brief note, but obviously Hu had no intention of proposing a new family name. Strictly, his publication of the name does not conform to Art. 37 of the International Rules of Botanical Nomenclature (ed. 3. 1935), which states: "A name of a taxonomic group is not validly published unless it is . . . accompanied by a description of the group or by a reference to a previously and effectively published description of it." It seems advisable to the writer to consider Hu's name a *nomen subnudum*.

1. Illicium

Illicium L. Syst. Nat. ed. 10. 1050. 1759, Gen. Pl. ed. 6. 244. 1764; Gleditsch, Syst. Pl. 107. 1764; L. Syst. Nat. ed. 12. **2**: 335. 1767; Hill, Hort. Kew. 227. 1769; L. Mant. Pl. 167. 1771; Murr. Syst. Veg. ed. 13. 422. 1774, ed. 14. 507. 1784; Scopoli, Introd. 252. 1777; Reichard, Gen. Pl. 282. 1778; Lam. Encycl. Méth. Bot. **1**: 351. 1783; Gaertn. Fruct. et Sem. Pl. **1**: 338. 1788; Schreb. Gen. Pl. 372. 1789; Juss. Gen. Pl. 280. 1789; Vitman, Summa Pl. **3**: 336. 1789; Lour. Fl. Cochinch. 353. 1790; Necker, Elem. Bot. **2**: 287. 1790; J. F. Gmel. Syst. Nat. **2**: 867. 1791; Vent. Tabl. Reg. Vég. **3**: 70. 1799; Willd. Sp. Pl. **2**: 1254. 1800; Michx. Fl. Bor.-Am. **1**: 326 (err. typ. 526). 1803; Jaume St.-Hil. Exp. Fam. Nat. **2**: 75. 1805; Duhamel, Traité Arb. et Arbust. **3**: 189. 1806; Pers. Syn. Pl. **2**: 93. 1806; DC. Reg. Veg. Syst. Nat. **1**: 440. 1817; Nutt. Gen. N. Am. Pl. **2**: 17. 1818; DC. Prodr. **1**: 77. 1824; Spreng. Gen. Pl. **1**: 458. 1830; G. Don, Gen. Syst. **1**: 78: 1831; Link, Handb. **2**: 373. 1831; Loudon, Arb. et Frut. Brit. **1**: 256. 1838; Torr. & Gray, Fl. N. Am. **1**: 42. 1838; Endl. Gen. Pl. 839. 1839; Spach, Hist. Nat. Veg. **7**: 439. 1839; A. Gray, Gen. Pl. U. S. **1**: 55. 1849; Hook. f. & Thoms. Fl. Ind. **1**: 73. 1855; Darby, Bot. Southern States **2**: 211. 1855; Chapman, Fl. Southern U. S. 12. 1860; Miers in Ann. Mag. Nat. Hist. III. **2**: 113. 1858, Contrib. Bot. **1**: 142. 1861;

Benth. & Hook. f. Gen. Pl. **1**: 18. 1862; Baill. Hist. Pl. **1**: 151, 189. 1868–69; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 39. 1872; Pfeiffer, Nom. Bot. **1**: 1743. 1874; Kurz, For. Fl. Brit. Burma **1**: 23. 1877; Nichols. Ill. Dict. Gard. **2**: 177. 1885; Prantl in E. & P. Nat. Pfl. III. **2**: 18. 1888; Maxim. in Bull. Acad. Sci. St. Pétersb. **32**: 479. 1888; King in Jour. As. Soc. Beng. **58** (*2*): 374. 1889, in Ann. Bot. Gard. Calcutta **3**: 199. 1891; A. Gray, Syn. Fl. N. Am. **1**: 58. 1895; Parment. in Bull. Sci. Fr. & Belg. **27**: 219. 1896; Harms in E. & P. Nat. Pfl. Nachtr. **1**: 158. 1897; v. Tiegh. in Jour. de Bot. **14**: 349. 1900; Bailey, Cycl. Am. Hort. **2**: 799. 1900; Small, Fl. Southeastern U. S. 450. 1903; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 27. 1905 [repr. Contr. Fl. As. Or. **2**: 27. 1907], in Lecomte, Fl. Gén. Indo-Chine **1**: 29. 1907; Dunn & Tutcher in Kew Bull. Add. Ser. **10**: 28. 1912; Bailey, Stand. Cycl. Hort. **3**: 1641. 1915; Ridley, Fl. Malay Penins. **1**: 18. 1922; Barker & Dardeau, Fl. Haïti 118. 1930; Nakai, Fl. Sylv. Koreana **20**: 111. 1933; Burkill, Dict. Econ. Prod. Mal. Penins. 1224. 1935; Rehder, Man. Cult. Trees and Shrubs ed. 2. 253. 1940; Wu in Bot. Jahrb. **71**: 176. 1940.

Badianifera L. Materia Medica 180. 1749; Kuntze, Rev. Gen. Pl. **1**: 6. 1891.

Skimmi Kaempf. ex Adans. Fam. Pl. **2**: 364. 1763.

Glabrous shrubs or small trees (young branchlets very rarely obscurely puberulent); bud-scales often conspicuous at apices of young branchlets, imbricate, soon caducous; leaves essentially alternate but often clustered or pseudoverticillate at distal nodes of branchlets, exstipulate, petiolate, the petioles canaliculate, sometimes deeply so, usually rugulose when dried, the blades chartaceous to coriaceous, pinnate-veined, decurrent on the petiole, entire; flowers solitary, sometimes appearing to arise in twos or threes, axillary or supra-axillary, sometimes appearing subterminal, often crowded among leaves toward apices of branchlets, rarely lateral on branchlets below leaves, very rarely arising from complex glomerules on trunk or large branches, pedicellate; pedicels terete, sometimes 1- or 2-bracteolate, subtended by few or numerous imbricate bracts, these usually soon caducous; flowers hermaphrodite, hypogynous, with free and usually numerous parts; torus convex to short-conical, terminating in an inconspicuous extension, this oblong to conical, often minutely papillose, usually concealed by the carpel-bases; perianth-segments numerous (7–33), usually several-seriate, often glandular, the outermost ones often small, sometimes bracteole-like, the inner ones gradually larger, ligulate and membranaceous (§ *Badiana*) or essentially carnose and ovate to suborbicular (§ *Cymbostemon*), the innermost ones often reduced in size, occasionally transitional toward stamens; stamens numerous (4–41 or rarely to 50), 1- to several-seriate, erect, composed of ligulate to subterete filaments and basifixed oblong 4-sporangiate anthers, the connective often carnose, sometimes glandular, usually subequal to or sometimes slightly exceeding the thecae in length, the thecae introrse-lateral, protuberant or subimmersed, dehiscing by longitudinal clefts for their entire length; carpels usually 7–15 (rarely 5–21), free, in a single whorl, often closely appressed laterally, obliquely attached to the torus by the broad base and lower part of ventral side, erect or subspreading, composed of a laterally flattened ovoid or ellipsoid ovary distally attenuate into a slender or stout acute style, the style conduplicate and stigmatic ventrally along all or most of its length, the ovary unilocular, with a single anatropous ovule borne ventrally near the base; fruit a follicetum composed of a single whorl of free spreading follicles, these oblong to ovoid, broad at base and often ventrally subauriculate, dehiscing ventrally, the dorsal follicle-walls often coriaceous, the lateral walls often thin, the ventral suture thickened, the style more or less persistent; seed with a subbasal hilum, usually ellipsoid or obovoid and laterally flattened, rounded on the dorsal edge, subacute on the ventral edge, rounded at apex, obliquely truncate at base, the testa usually stramineous or brownish, smooth, glossy, brittle, the endosperm copious, oily, the embryo minute, near the hilum.

TYPE SPECIES: *Illicium anisatum* L., which dates from the same place as the generic description.

DISTRIBUTION: Southeastern Asia (Japan, China, and northeastern India to the Philippines, Borneo, Malay Peninsula, and Sumatra) and southeastern North America (southeastern U. S., eastern Mexico, Cuba, and Haiti). See map, *fig. 1.* Forty-two species are recognized in this treatment.

As implied above, the genus *Illicium* is so distinct and readily recognized that it cannot, in fertile condition, be confused with any other group of plants. Curi-

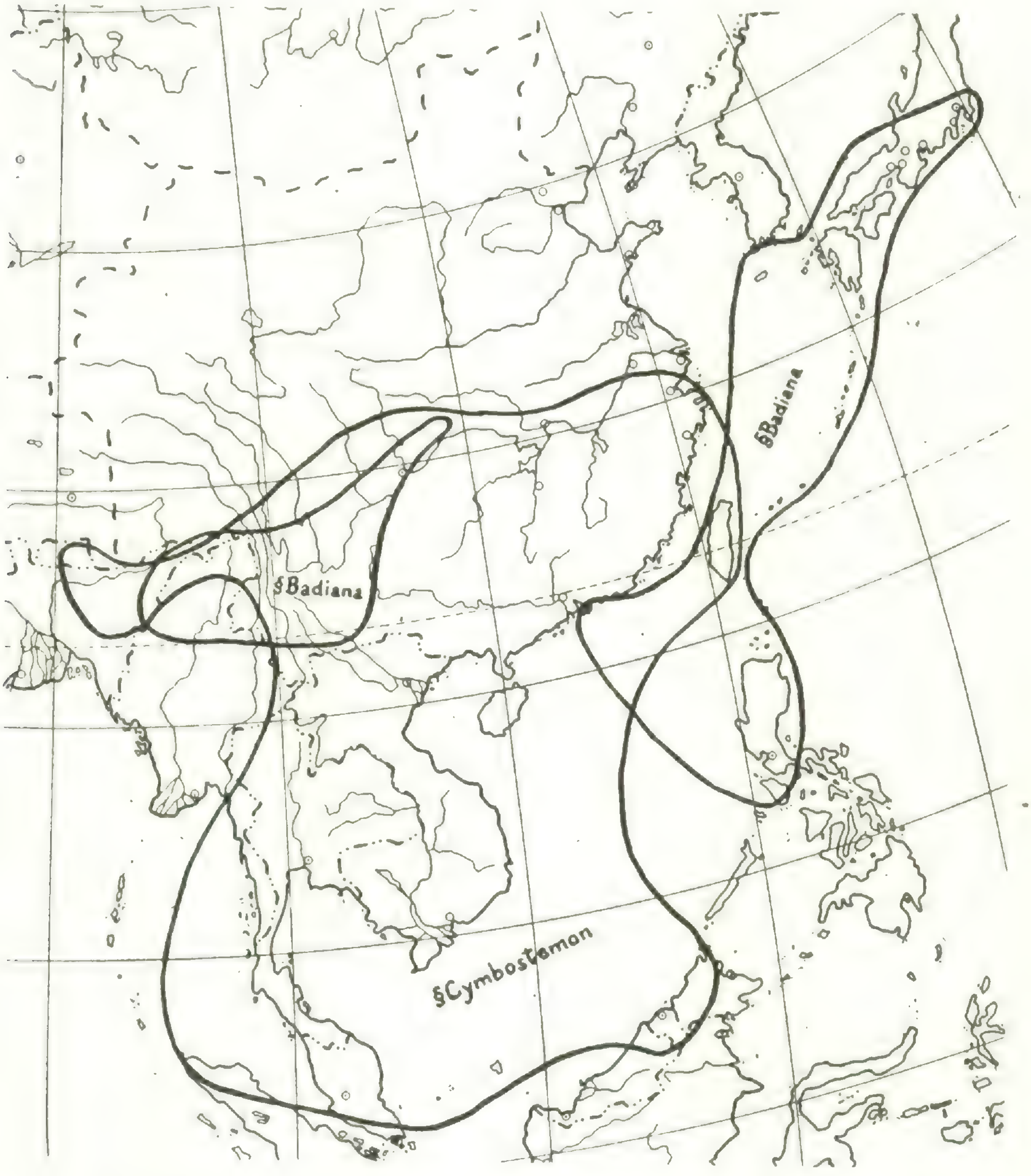

FIG. 3. Generalized distribution of the two sections of *Illicium* in the Eastern Hemisphere.

ously, certain species bear a remarkable superficial resemblance to members of the Ternstroemiaceae; one described *Illicium, I. evenium* King, is actually a species of *Ternstroemia*, while *Ternstroemia khasyana* Choisy is actually a synonym of *I. Griffithii.* Such misplacings, however, have been rare, and in general the generic identity of species of *Illicium* is instantly apparent.

To a lesser but still very obvious degree, *Illicium* is divisible into two subdivisions, recognized in this paper and discussed below as the sections *Badiana* and *Cymbostemon*. Below these sectional limits, however, the genus becomes extraordinarily complex and taxonomically difficult. With the exception of certain well-defined entities (e. g. *I. floridanum, I. verum*), the species have been confused in herbaria and literature to such an extent that identification has become a matter of pure speculation.

On the basis of their comparative morphology, it seems impossible to state which of the two sections of *Illicium* is the more primitive, and the present geographical distribution throws no light on this question. In the Western Hemisphere, the two sections occupy discrete ranges (see map, *fig. 4*). In the Eastern

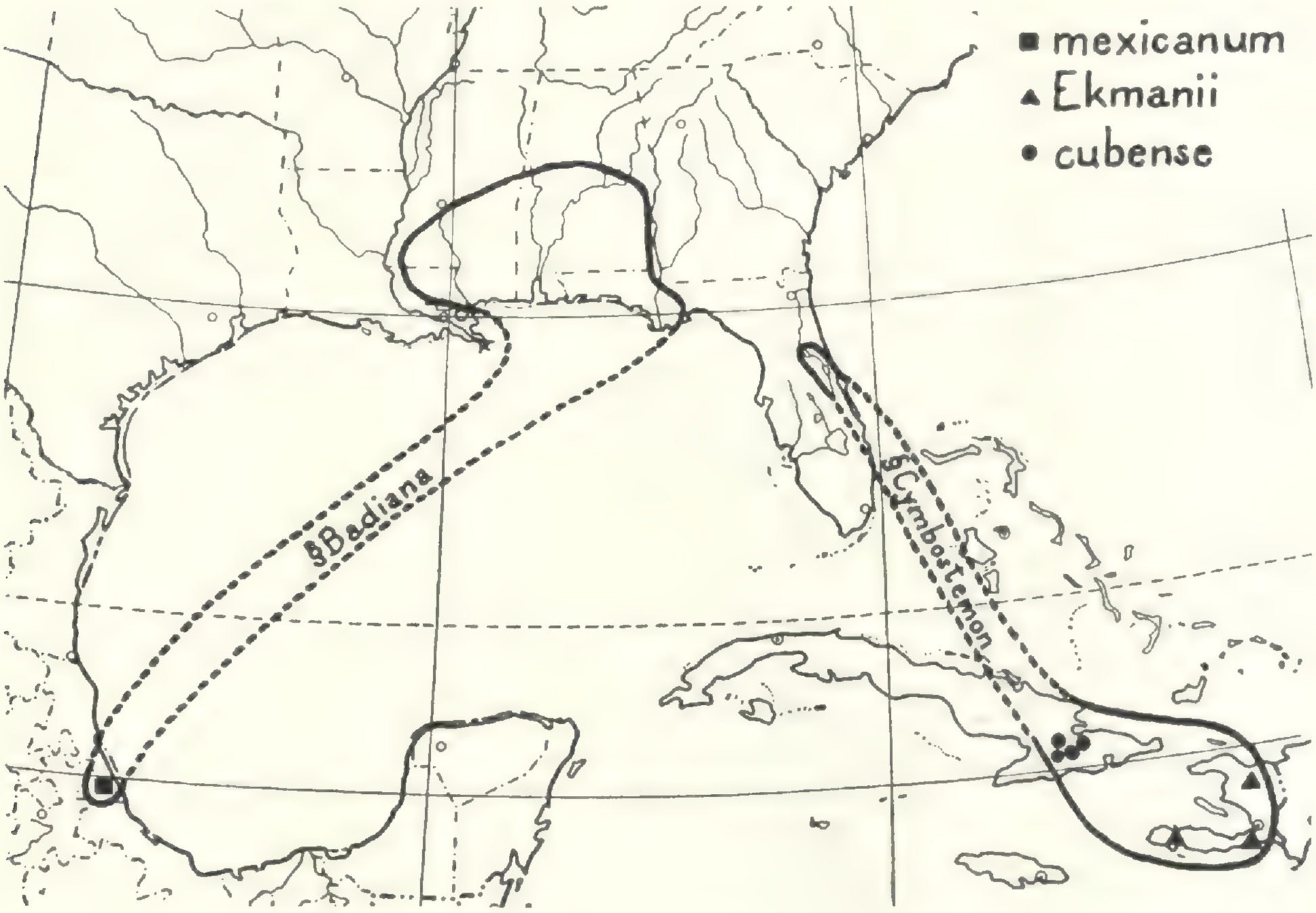

FIG. 4. Generalized distribution of the two sections of *Illicium* in the Western Hemisphere, with more detailed distribution indicated for *I. mexicanum, I. Ekmanii,* and *I. cubense.*

Hemisphere the two sections have superimposed ranges in part (see map, *fig. 3*), but it should be noted that § *Cymbostemon* occurs farther south than § *Badiana*. The latter section has its range broken into two parts, one part in southwestern China to northeastern India, and the other part predominantly insular from Japan to the Philippines.

KEY TO THE SECTIONS

Inner perianth-segments thin, membranaceous, somewhat lax at anthesis, narrowly oblong or ligulate or lanceolate .....§ BADIANA (spp. 1–13).
Inner perianth-segments carnose to papyraceous, not lax, usually ovate to suborbicular. § CYMBOSTEMON (spp. 14–42).

A basic division of *Illicium* into two minor groups is immediately suggested by the perianth-characters utilized above. This division is sharp and unmis-

takable, there being no species about which doubt can be entertained if flowers are available. Unfortunately this excellent floral character is not paralleled by any fruit-character which is discernible, and one can place fruiting specimens only by experience and by careful comparison in a well-documented herbarium.

That the division here proposed is somewhat more than trivial is supported by studies of the detailed morphology of the genus being made by Prof. Bailey and Dr. Nast. The foliar sclereids in the two sections show some striking dissimilarities, as will be discussed in a subsequent paper by my colleagues. Furthermore, the type of pollen grain is different in the two sections, but here one must admit a lack of complete correlation; the American species of § *Badiana* have the type of pollen grain otherwise found in § *Cymbostemon*, a fact which serves to emphasize the isolation of these American species. For further information concerning the anatomical and morphological basis for dividing *Illicium*, the reader is referred to the forthcoming treatment of Bailey and Nast.

The first student to break up the larger concept of *Illicium* was Spach (Hist. Nat. Veg. **7**: 439–446. 1839). He proposed a new genus (*Cymbostemon*) for *I. parviflorum* alone. For his interpretation of *Illicium* he proposed two sections: (1) § *Badiana*, based on *I. religiosum* and *I. anisatum* (erroneously interpreting these as two distinct species), and (2) § *Euillicium*, based on *I. floridanum* alone. It is to be noted that Spach used the name *Euillicium* in an incorrect nomenclatural sense, since *I. anisatum* and not *I. floridanum* is the genotype.

Baillon (Hist. Pl. **1**: 151–156, 189–190. 1868–69) also recognized the two primary divisions with *Illicium*, but he did not propose sectional names as such. He merely mentioned that the American species with inflated filaments belong in "*Cymbostemon*," while *I. anisatum* and its allies belong in "*Euillicium*." It must be noted that Baillon's use of the name *Euillicium* is strictly synonymous with Spach's use of § *Badiana;* it is not synonymous with Spach's use of § *Euillicium*, which was based solely upon *I. floridanum*. This fact is not of great importance, since we now place *I. floridanum* and *I. anisatum* in the same section. However, Baillon's use of the name *Euillicium* should in no way be interpreted as a formal choice between Spach's two names for this concept. It was Baillon's privilege, as the first student after Spach using such names, to make a choice which we should now have to follow, but this privilege was not taken.

In view of the facts brought out above, it appears that the choice between the names *Badiana* and *Euillicium*, since both refer to the same sectional concept, is still to be made. Since § *Badiana* includes the genotype I believe it to be the preferable sectional name, to the synonymy of which I herewith reduce § *Euillicium* Spach.

Section Badiana

Illicium sect. **Badiana** Spach, Hist. Nat. Veg. **7**: 440. 1839.

Illicium sect. *Euillicium* Spach, Hist. Nat. Veg. **7**: 443. 1839.

Illicium (*Euillicium*) Baill. Hist. Pl. **1**: 156, 190. 1868–69.

The type-including section of the genus, based, as noted in the key above, primarily upon having its inner perianth-segments thin and membranaceous, somewhat lax at anthesis, and narrowly oblong to ligulate or lanceolate in shape.

Type species: *Illicium anisatum*, the genotype. Although Spach's concept of this species was confused, he based his section upon it and *I. religiosum*, which is a synonym.

Distribution: In the Eastern Hemisphere from Japan (central Honshu) and southern Korea southward, including Formosa and the Chinese coast at Hongkong, to the northern Philippines (Luzon and Mindoro), and also in southwestern China, northern Burma, and

adjacent northeastern India; in the Western Hemisphere in the southeastern U. S. (Florida to Louisiana) and eastern Mexico (Vera Cruz). See maps, *figs. 3* and *4*. Thirteen species, of which two are American, are recognized in this treatment.

Adequately to classify the species of § *Badiana* has taxed the writer's ability, and the arrangement here presented is put forth with full realization of its unsatisfactory nature. Within the section, the two American species are readily set apart by their perianth-color, long pedicels, and comparatively large number of floral parts. The Asiatic species of § *Badiana* present no differentiating characters which can be easily coördinated. There appear to be two large complexes of species, one centering around *I. Simonsii* and continental in distribution (my spp. 1–6), the other primarily insular, centering around *I. anisatum* (my spp. 7–11). The difficulties inherent in the taxonomy of these species will become apparent to the reader who follows this treatment and attempts to use my key. More detailed notes will be found following the descriptions of *I. Simonsii* and *I. anisatum*.

Section Cymbostemon

Illicium sect. **Cymbostemon** (Spach) comb. nov.

Cymbostemon Spach, Hist. Nat. Veg. **7**: 444. 1839.

Illicium (*Cymbostemon*) Baill. Hist. Pl. **1**: 155, 189. 1868–69.

The larger of the two sections of *Illicium*, as regards number of species, based primarily upon having its inner perianth-segments carnose to papyraceous, not lax, and usually ovate to suborbicular.

Type species: *Illicium parviflorum*, the sole basis of Spach's genus.

Distribution: In the Eastern Hemisphere from central China and northeastern India southward, including Formosa and Hainan, to northern Borneo, the Malay Peninsula, and northern Sumatra; in the Western Hemisphere in eastern Florida, eastern Cuba, and Haiti. See maps, *figs. 3* and *4*. Twenty-nine species, of which three are American, are recognized in this treatment.

Section *Cymbostemon*, in spite of its greater size, seems much less difficult taxonomically than § *Badiana*. Here most of the entities are susceptible to adequate circumscription. The reader attempting to use my key may object to the fact that the primary division within § *Cymbostemon* is mechanically based upon numbers of carpels and stamens. I am aware that this division may not in all cases give a true picture of the actual relationships, but as an artificial device it is quite dependable in this group. Unless it is utilized I am at a loss to break down the section into smaller groups. Quite possibly length of style or degree of immersion or prominence of the thecae are characters of greater phylogenetic consequence; that I have not used such characters as first steps in the key will, in my opinion, make it more usable if not more philosophical. As a few species vary in number of parts beyond the limits of my first division, they have been double- or in one case triple-keyed. Additional keys which cut across the primary break-down will be found here and there throughout the text; it is hoped that these will clarify certain difficult complexes. Actually, the species of § *Cymbostemon* are usually well-marked and geographically sharply delimited; the most difficult species-complex is perhaps the one involving *I. majus*, *I. Henryi*, and *I. lanceolatum*, which is discussed under *I. majus* below.

Unless flowers are available, the keys here offered will be found practically useless. Fruiting or sterile material can be identified only by painstaking comparison in a large herbarium, and with close reference to the known geographical limits of each species.

Keys to the species

§ Badiana

Asiatic species; pedicels comparatively short, at anthesis rarely exceeding 25 mm. in length (sometimes up to 33 mm. in no. 6); perianth-segments 12–32, usually yellowish, often white or greenish, in a few species pink-tinged or purplish; stamens 11–35; carpels 7–14.

Species of inland continental Asia; pedicels very short, 2–10 mm. long at anthesis, rarely to 16 or 20 mm. long in fruit, the flowers appearing subsessile and aggregated (although actually solitary); leaf-apex cuspidate to acuminate, callose-acute or callose-apiculate.

Leaf-blades with secondary nerves prominulous on both surfaces, irregularly spreading, copiously anastomosing; perianth-segments 20–27, whitish purple, the largest ones 13–15 mm. long; stamens 20–24, the anthers rather large, 2.1–2.7 mm. long; carpels 8–12; northern Burma .....1. *I. burmanicum.*

Leaf-blades with secondary nerves usually obscure or impressed above, fairly straight, comparatively ascending, the anastomoses usually inconspicuous; perianth-segments white to yellow or greenish, occasionally pink-tinged.

Perianth-segments 27–32, the largest ones at least 14 mm. long at anthesis; stamens 21 or more, the anthers averaging large, 1.5–2.5 mm. long; carpels 12–14.

Stamens 28–35; perianth-segments pale yellow to white, or pink-tinged, the largest ones 14–17 (–21) mm. long; northern Burma .....2. *I. Wardii.*

Stamens 21–26; perianth-segments white to greenish, the largest ones 15–25 mm. long; southern Yünnan .....3. *I. macranthum.*

Perianth-segments 16–23 (–26), the largest ones 8–15 (–18) mm. long at anthesis; stamens usually 18–25 (sometimes 12–28), the anthers 1.2–2.4 mm. long; carpels 8–13.

Stamens 16–28, the anthers 1.4–2.4 mm. long; perianth-segments 18–26, the largest ones 9–15 (–18) mm. long; carpels 8–13; plant comparatively robust, with pedicels hardly less than 1.5 mm. in diameter at anthesis; Szechuan to Assam .....4. *I. Simonsii.*

Stamens 12 or 13, the anthers 1.2–1.5 mm. long; perianth-segments 16–19, the largest ones 8–12 mm. long; carpels 8; plant comparatively slender, with pedicels 1–1.2 mm. in diameter at anthesis; southern Yünnan .....5. *I. Tsaii.*

Species of coastal and insular East Asia (except no. 6); pedicels obvious, 4–33 (usually more than 10) mm. long at anthesis, the flowers obviously solitary; leaf-apex various, sometimes obtuse.

Carpels usually 8 (occasionally 7–10).

Actual apex of leaf-blades callose-mucronulate; leaf-blades prevailingly lanceolate-oblong or ovate-elliptic, broadest near or slightly below middle, about 2.5 times as long as broad, acuminate at apex, the secondary nerves 6–9 per side, spreading, faintly impressed above, slightly raised beneath; perianth-segments 22–24, the largest ones 13–18 mm. long; stamens 17–19; carpels 7 or 8 (–9?); Assam and northern Burma .....6. *I. manipurense.*

Actual apex of leaf-blades obtuse to acute, not callose-mucronulate; leaf-blades with 4–7 secondary nerves; Japan and Korea southward to Philippines.

Leaf-blades prevailingly obovate, usually broadest above middle, sometimes elliptic, usually 2–3 times as long as broad, obtuse or cuspidate or short-acuminate at apex (actual apex obtuse), not noticeably thickened at margin, the secondary nerves 4–6 per side, ascending, usually elevated but not very conspicuous on both sides; perianth-segments 17–24, white to yellow (at least the inner ones usually yellowish), the largest ones 11–23 mm. long; stamens 17–25; carpels 8, rarely 9 or 10; Japan (Honshu to Yakushima) and southern Korea.
7. I. anisatum.

Leaf-blades prevailingly lanceolate or lance-obovate, broadest near or slightly above middle, usually 3–4 times as long as broad, gradually narrowed to apex (actual apex slightly callose-thickened, obtuse or subacute), callose-thickened and sometimes narrowly revolute at margin, the secondary nerves about 4 per side, essentially completely immersed; perianth-segments 17–19, pale yellow or white, the largest ones 11–17 mm. long; stamens 11–20; carpels 7–10; northern and central Ryu Kyu Islands .....8. *I. Masa-Ogatai.*

Leaf-blades prevailingly lanceolate or narrowly oblong-elliptic, broadest near middle, usually 2.5–4 times as long as broad, acute to gradually acuminate at apex (actual apex acute to obtuse), not noticeably thickened at margin but often slightly recurved, the secondary nerves 5–7 per side, faintly raised on both sides or essentially immersed; perianth-segments 15–21, white, the largest ones 11–17 mm. long; stamens 16–23; carpels 8 (rarely 9 or 10) at anthesis; Formosa and Philippine Islands .....9. *I. philippinense.*

Carpels 11–13; largest perianth-segments not exceeding 15 mm. in length.

Stamens 17–20; perianth-segments 12–20, the inner ones narrowly oblong, 1.5–4 mm. broad, the innermost 2–4 lanceolate or subulate, short; southern Ryu Kyu Islands and Formosa .....10. *I. Tashiroi.*

Stamens about 24; perianth-segments 22–24, the innermost 12–14 linear-filiform, 0.7–2 mm. broad; Hongkong. .....11. *I. angustisepalum.*

American species; pedicels comparatively long, usually 18–50 mm. long at anthesis (rarely 10 mm., sometimes up to 105 mm.); perianth-segments 21–33, deep red to purple; stamens 25–38 (–50); carpels usually (10–) 11–15 (or up to 21).

Pedicels at anthesis usually 18–50 mm. long, very rarely longer; 2–5 outermost perianth-segments obviously smaller than the middle series, all the segments (except inner ones) rounded or obtuse at apex; carpels at anthesis usually 11–15 (rarely to 17, very rarely to 20), the ovary flattened-ellipsoid or triquetrous, at anthesis usually less than 1.5 mm. broad at base; southeastern U. S. .....12. *I. floridanum.*

Pedicels at anthesis and in fruit 80–105 mm. long; outermost perianth-segments the largest, 15–20 mm. long at full anthesis, all the segments acute at apex; carpels at anthesis 19–21 (fewer, about 13, in fruit), the ovary broadly deltoid, 2–3 mm. broad at base; Vera Cruz, Mexico .....13. *I. mexicanum.*

§ Cymbostemon

Carpels 11–14 (–16), very rarely 9 or 10. Group I.

Stamens 6–11 .....Group I, A (spp. 14–16).

Stamens 12–21 (rarely 22) .....Group I, B (spp. 17–22).

Stamens 22–41 .....Group I, C (spp. 23–27).

Carpels (5–) 7–9 (rarely 10). Group II.

Stamens 4–7 .....Group II, A (spp. 28–30).

Stamens 9 or more (sometimes 7 in sp. 31) .....Group II, B (spp. 31–42).

§ Cymbostemon, Group I, A

Leaf-blades rounded to acute at apex; pedicels (7–) 9–23 mm. long at anthesis and in fruit; flowers comparatively small, the largest perianth-segments not more than 7 mm. long; filaments carnose, thickened distally, the thecae semi-immersed; carpels 1.7–2.5 mm. long at anthesis, the style stout, shorter than ovary, inconspicuous in fruit; American species.

Apex of leaf-blades rounded or broadly obtuse or faintly emarginate; perianth-segments 12–15, the largest ones 5.5–7 mm. long; stamens 6 or 7, 2.5–3.5 mm. long; eastern Florida, cultivated in other southeastern States .....14. *I. parviflorum.*

Apex of leaf-blades acute or, if obtuse, obscurely mucronate; perianth-segments about 20, the largest ones not exceeding 4 mm. in length; stamens 8 (uniformly?), not exceeding 2 mm. in length; Haiti .....15. *I. Ekmanii.*

Leaf-blades acuminate or at least obviously cuspidate at apex; pedicels 15–50 mm. long at anthesis, rarely up to 80 mm. long in fruit; flowers larger, the largest perianth-segments 7–12.5 mm. long; filaments ligulate, the anthers clearly distinct and with protuberant thecae; carpels 3.9–5.3 mm. long at anthesis, the style subulate, longer than ovary, obvious in fruit; eastern China .....16. *I. lanceolatum.*

§ Cymbostemon, Group I, B

Leaf-blades small, (3–) 4–6.5 cm. long, obtuse to rounded at apex; perianth-segments about 13; filaments and connectives thickened, with semi-immersed thecae; style longer than ovary; Indo-China .....17. *I. parvifolium.*

Leaf-blades larger (usually much exceeding 6 cm. in length), acuminate or obviously cuspidate at apex.

Carpels 3–5.5 mm. long at anthesis, the style subulate, slender, 1.5–3.5 mm. long, exceeding the ovary in length, obvious in fruit.

Flowers arising from branchlets below leaves; largest perianth-segments 7–8 mm. long; stamens about 20, uniseriate, the anthers conspicuously papillose, the thecae not protuberant; leaf-blades lanceolate-elliptic, with obscure secondaries; Borneo.
18. *I. cauliflorum.*

Flowers associated with foliage; largest perianth-segments 8–15 mm. long; stamens 1- or 2-seriate, the anthers not papillose, the thecae protuberant or slightly so; continental species.

Petioles 5–15 mm. long; leaf-blades broadly elliptic or obovate-elliptic, 2–2.5 times as long as broad, obtuse at base; southern Indo-China and southern Burma.
19. *I. cambodianum.*

Petioles (8–) 12–20 (–30) mm. long; leaf-blades oblong-lanceolate or narrowly oblanceolate, 3–4 times as long as broad, gradually narrowed toward base; southern China (Kweichow and western Szechuan southward) to northern Indo-China and southern Burma .....20. *I. majus.*

Carpels 2.3–3.4 mm. long at anthesis, the style conical-subulate, 0.8–1.6 (–2) mm. long, shorter than ovary or essentially equal to it in length, obscure in fruit; leaves often clustered in whorls of 3–5 toward apices of branchlets, the blades coriaceous.

Perianth-segments 9–11; leaf-blades (5–) 7–14 cm. long; Hunan, Kwangtung, Kwangsi.
21. *I. brevistylum.*

Perianth-segments about 19; leaf-blades comparatively small, (4–) 5–7.5 cm. long; Yünnan .....22. *I. modestum.*

§ Cymbostemon, Group I, C

Perianth-segments numerous, 21–26; stamens about 29 or 30; leaf-blades narrowly oblong or lanceolate.

Secondary nerves raised or sharply prominulous beneath; perianth-segments 25 or 26; style very slender, subulate, obviously exceeding the ovary in length; Assam and Bhutan .....23. *I. Griffithii.*

Secondary nerves immersed, scarcely visible beneath; perianth-segments 21–23; style subequal to ovary in length; Hongkong .....24. *I. leiophyllum.*

Perianth-segments fewer, 10–21.

Stamens 39–41; leaf-blades narrowly oblong- or obovate-elliptic, about 3 times as long as broad; Formosa .....25. *I. arborescens.*

Stamens 22–33.

Leaf-blades elliptic to obovate-elliptic, 2–2.5 times as long as broad, 4–9 cm. broad, obtuse at base, cuspidate at apex; Malay Peninsula .....26. *I. peninsulare.*

Leaf-blades oblong-elliptic or oblanceolate or narrowly obovate, usually at least 3 times as long as broad, gradually acuminate at apex.

Pedicel comparatively stout, 1–1.5 mm. in diameter proximally at anthesis; perianth-segments 10–14, the largest ones 7–12 mm. long; fruit comparatively robust, the seeds 6–7 mm. long at maturity; leaf-blades usually 2–5 cm. broad; Hainan.
27. *I. ternstroemioides.*

Pedicel very slender, 0.5–1 mm. in diameter proximally at anthesis; perianth-segments 12–20, the largest ones 6–9 mm. long; fruit comparatively delicate, the seeds 4–5 mm. long at maturity; leaf-blades usually 1.2–2.7 cm. broad; Hongkong, Kwangtung, Kwangsi, and Kweichow .....39. *I. Dunnianum.*

§ Cymbostemon, Group II, A

Apex of leaf-blades rounded or broadly obtuse, sometimes faintly emarginate, sometimes obtusely short-cuspidate.

Perianth-segments 15 or 16, at least the inner ones red, the largest ones 4.5–6.5 mm. long; stamens 4 or 5; leaf-blades brownish and nearly concolorous when dried; Cuba.
28. *I. cubense.*

Perianth-segments 11–18, usually greenish yellow, the largest ones 5–10 mm. long; stamens 4–7; leaf-blades usually greenish above and much darker and brownish beneath when dried; Hainan .....29. *I. oligandrum.*

Apex of leaf-blades acuminate; perianth-segments 10–15; stamens about 7; Borneo.
30. *I. kinabaluense.*

§ Cymbostemon, Group II, B

Style long-subulate, obviously exceeding the ovary in length at anthesis, usually 2–3 mm. long or more; carpels usually 3–4 mm. long or more at anthesis.

Stamens 7–10; perianth-segments 14–17; pedicels 14–32 mm. long at anthesis and in young fruit; leaves irregularly spaced on branchlets, paired or in threes or fours at distal nodes, the blades thick-coriaceous, the secondaries essentially completely immersed; Kwangtung .....31. *I. Tsangii.*

Stamens (10–) 11–18.

Outermost perianth-segments sometimes reduced in size but very rarely less than 3 mm. long.

Perianth-segments 8–14 (sometimes 15 in no. 34); stamens 10–14.

Stamens 1.8–3.5 mm. long, the filaments contracted at least slightly at apex; leaf-blades narrowly oblong-elliptic to lanceolate, usually at least 3 times as long as broad; China.

Pedicels (rarely 10–) 15–46 mm. long at anthesis; leaves irregularly spaced on branchlets, paired or loosely clustered at distal nodes, the blades coriaceous but usually with visible secondaries; Shensi to Kiangsi, most abundant in western Hupeh .....32a. *I. Henryi* var. *typicum.*

Pedicels 3–5 mm. long at anthesis, not exceeding 9 mm. long in full fruit; leaves pseudoverticillate at distal nodes in clusters of 4–7, the blades thick-coriaceous, with immersed secondaries; Kwangsi .....33. *I. pachyphyllum.*

Stamens 3.5–4.2 mm. long, the filaments not contracted at apex; leaf-blades coriaceous or thick-coriaceous, elliptic, usually about twice as long as broad; Borneo and Malay Peninsula.

Leaf-blades usually 11–17 cm. long and 5–9 cm. broad; perianth-segments 12–15, the largest ones 9–12 mm. long; Borneo .....34. *I. Stapfii.*

Leaf-blades usually 5–10 cm. long and 2.5–4.5 cm. broad; perianth-segments 8–13, the largest ones not exceeding 9.5 mm. in length; Malay Peninsula.
35. *I. Ridleyanum.*

Perianth-segments 15–20, the outermost ones 3–6.5 mm. long; stamens 14–18; pedicels 20–40 mm. long at anthesis; leaf-blades coriaceous, elliptic or lanceolate, acuminate, usually 2–5 cm. broad; northern Burma and Yünnan .....36. *I. Merrillianum.*

Outermost perianth-segments greatly reduced, bracteole-like, 1–2.5 mm. long; perianth-segments 11–19 in number, the largest ones 4–7.5 mm. long, the innermost ones carnose, oblong to elliptic, 3–6 mm. long; stamens 11–16; Malay Peninsula and Sumatra.

Perianth-segments 11–18; stamens 2–3.2 mm. long, the filaments thin-carnose, ligulate, the thecae 0.8–1.4 mm. long; leaf-blades papyraceous to chartaceous, usually plane at margin; Malay Peninsula .....37. *I. tenuifolium.*

Perianth-segments 18 or 19; stamens 3.3–3.7 mm. long, the filaments thick-carnose, subterete distally, the thecae, 1.4–1.8 mm. long; leaf-blades coriaceous, with strongly recurved margins; Sumatra .....38. *I. sumatranum.*

Stamens 19–31, very rarely fewer.

Leaves irregularly spaced on branchlets, sometimes in threes or fours at distal nodes; pedicels comparatively stout, at least 1 mm. in diameter proximally at anthesis; stamens with conspicuously protuberant thecae; carpels usually about 4 mm. long at anthesis; fruit comparatively robust, the seeds 6.5 mm. long or more at maturity; eastern Szechuan .....32b. *I. Henryi* var. *multistamineum.*

Leaves in pseudoverticils of 3–8 at distal nodes of branchlets; pedicels very slender, 0.5–1 mm. in diameter proximally at anthesis; stamens with slightly protuberant thecae; carpels 2.5–3.5 mm. long at anthesis; fruit comparatively delicate, the seeds 4–5 mm. long at maturity; Hongkong, Kwangtung, Kwangsi, and Kweichow.
39. *I. Dunnianum.*

Style comparatively short, often stout, shorter than ovary or subequal to it at anthesis, 1–2 mm. long; carpels not much exceeding 3 mm. in length at anthesis, often shorter.

Leaves pseudoverticillate, aggregated in clusters of 3–8 at distal nodes of branchlets, the blades lanceolate or oblanceolate; pedicels very slender; perianth-segments 12–20; stamens 19–31, rarely fewer; fruit comparatively delicate, the seeds 4–5 mm. long at maturity; Hongkong, Kwangtung, Kwangsi, and Kweichow .....39. *I. Dunnianum.*

Leaves usually irregularly spaced on branchlets, sometimes in threes or fours at distal nodes, the blades variously shaped, narrowly elliptic-oblong to obovate-elliptic; stamens 9–20.

Perianth-segments 17–20, the largest ones 5–8 mm. long; stamens with subimmersed thecae; seeds at maturity 4.5–5 mm. long; pedicels 7–28 mm. long at anthesis; Yünnan and southern Szechuan .....40. *I. micranthum.*

Perianth-segments 7–13, the largest ones 6–9 mm. long; stamens with slightly protuberant thecae; seeds at maturity 6–9 mm. long.

Pedicel comparatively stout, 1–1.5 mm. in diameter at anthesis; outer perianth-segments papyraceous, the inner ones carnose, the largest ones often as broad as or broader than long; carpels 7–9 (rarely 10); leaf-blades green to olivaceous when dried; Kwangsi and Kwangtung .....41. *I. verum.*

Pedicel very slender, 0.5–1 mm. in diameter at anthesis; perianth-segments, except for the few innermost ones, submembranous or thin-papyraceous, the largest ones elliptic to obovate, longer than broad; carpels 5–8; leaf-blades dull brown when dried; northern Indo-China .....42. *I. Petelotii.*

1. **Illicium** (§ *Badiana*) **burmanicum** Wilson in Jour. Arnold Arb. 7: 238. 1926.

Shrub or small tree 4–8 m. high, the young branchlets rugulose, brownish, lightly angled, 3–5 mm. in diameter, at length subterete, up to 7 mm. in diameter, covered with a thick loose cinereous bark; bud-scales papyraceous, lanceolate-ovate, acuminate, the largest ones 12–15 mm. long; leaves in lax clusters of 4–10 at apices of branchlets; petioles 15–30 mm. long, 1–2 mm. in diameter; leaf-blades chartaceous, when dried dark olivaceous above and brown beneath, oblong-lanceolate to obovate-oblong, 7–12 cm. long, (2–) 2.5–4.5 cm. broad, acute at base, cuspidate to a short callose-acute apex, narrowly recurved at margin, the costa impressed above, prominent beneath, the secondary nerves 8–12 per side, irregularly spreading, freely anastomosing, prominulous on both surfaces or nearly plane above, the veinlets often obvious and prominulous beneath; flowers axillary, appearing clustered among petiole-bases, the subtending bracts several, papyraceous, elliptic-oblong, ciliolate, up to 10 × 8 mm.; pedicels stout (2.5–3 mm. in diameter), 3–8 mm. long at anthesis, ebracteolate; perianth-segments 20–27, the outer 3 or 4 papyraceous, densely pellucid-glandular, elliptic or oblong-elliptic, ciliolate, rounded at apex, the smallest ones 9–11 × 7–8 mm., the intermediate (largest) segments similar in texture, essentially eciliate, oblong-obovate, 13–15 × 3–5.5 mm., the innermost few increasingly shorter and narrower and more deeply colored; stamens about 2-seriate, 20–24, oblong, 3.8–4.2 mm. long, the filaments subcarnose, ligulate, 1.2–1.6 mm. long, the connective truncate or slightly produced and obtuse, the thecae somewhat protuberant, 2.1–2.7 mm. long; carpels 8–12 at anthesis, 4–5 mm. long, the ovary 1.5–2.5 mm. long, attenuate into a subulate style 2–3 mm. long, this often slightly recurved, usually stigmatic nearly to base; fruits not seen.

Type locality: Northern Burma; type, *Rock 7408,* cited below.

Distribution: Known only from the type locality, at an elevation of about 2700 m. See map, *fig. 5.*

BURMA: Sagaing: Myitkyina: Between Sadon and the Yünnan border at Changtifang and Kambaiti, *J. F. Rock 7399* (A, UC, US), *7408* (A type, NY, UC, US) (Nov. 13, 14, 1922).

Color notes: The perianth-segments are said to be whitish purple or purplish white. Both available collections were at full anthesis in November.

Among the inland continental species of § *Badiana, I burmanicum* is perhaps the most distinct, on the basis of its comparatively obvious and irregular leaf-venation, its colored and fairly broad perianth-segments, and its large anthers.

2. **Illicium** (§ *Badiana*) **Wardii** sp. nov.

Illicium burmanicum sensu Merr. in Brittonia **4**: 53, p. p. 1941; non Wilson.

Arbor parva ad 10 m. alta, ramulis hornotinis brunneis leviter angulatis 2.5–4

mm. diametro, annotinis cinereis subteretibus ad 6 mm. diametro; squamis subcoriaceis oblongis, maximis 8–13 mm. longis; foliis suboppositis vel ad nodos distales 3 vel 4 aggregatis, petiolis 12–20 mm. longis 1–3 mm. diametro; laminis coriaceis in sicco supra fusco-viridibus vel olivaceis subtus fuscis, anguste oblongo-ellipticis, 8–12 cm. longis, 2.5–5 cm. latis, basi acutis, apice cuspidatis vel breviter acuminatis et calloso-acutis, margine anguste recurvatis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 8–13 erecto-patentibus supra impressis vel planis subtus leviter elevatis vel prominulis; floribus axillaribus ut videtur inter petiolos confertis, bracteis basalibus paucis papyraceis oblongo-ellipticis ad 9 mm. longis latisque; pedicellis sub anthesi 6–10 mm. longis plerumque 1.8–3 mm. diametro ebracteolatis; segmentis perianthii 27–30, exteri-

oribus 1 vel 2 tenuiter papyraceis ciliolatis obscure glandulosis oblongis 10–11 × 6–8 mm., maximis membranaceis obscure ciliolatis oblongo-ligulatis 14–17 (–21) × 2.5–4.5 mm., interioribus 15–17 reductis ligulato-lanceolatis eciliatis, intimis (5–8) 8–11 × 1.5–2 mm.; staminibus plerumque 3-seriatis 28–35, 3.5–4.5 mm. longis, filamentis ligulatis 1.5–2.5 mm. longis, antheris oblongis 1.9–2.5 mm. longis, connectivo obtuse cuspidato; carpellis subanthesi 12 vel 13, 4–6 mm. longis, ovario complanato-ovoideo 1.5–2 mm. longo, stylo subulato 2.3–4 mm. longo omnino stigmatifero; pedicellis sub fructu paullo incrassatis, carpellis maturis 12 vel 13 patentibus, 25–28 mm. longis, 10–11 mm. latis, 2–3 mm. crassis, in acuminem conspicuum angustum 10–15 mm. longum attenuatis.

TYPE LOCALITY: Northern Burma; type, *Ward 387*, cited below.

DISTRIBUTION: Northern Burma, at altitudes of 1800–2700 m., in evergreen temperate hill forest. See map, *fig. 5*.

BURMA: SAGAING: Myitkyina: Near Panwa Pass, *F. K. Ward 387* (A TYPE, NY) (Mar. 11, 1939); above Langyaw, *C. W. D. Kermode 16693* (K); Bhamo: Naru Bum, *Saw Maung Mya* (in *C. E. Parkinson*) *5327* (K).

COLOR NOTES: The type is said to have perianth-segments a mixture of cream and dingy pink, while the other specimens are said to have white or yellow flowers. All the cited specimens were collected in anthesis in March, and all are reported to have fragrant flowers; the type collection is accompanied by detached fruits.

SYNONYMY: In 1941 Merrill cited two Ward specimens as representing *I. burmanicum;* one of these is taken as the type of my new species, and the other (no. *335*) is referred to *I. Simonsii.*

Illicium Wardii seems to merit specific segregation from the *I. Simonsii* complex because of its numerous perianth-segments and stamens. The type collection, in its perianth-color, indicates a tendency toward the colored condition of *I. burmanicum.*

3. **Illicium** (§ *Badiana*) **macranthum** sp. nov.

Frutex vel arbor parva 3–7 m. alta, ramulis hornotinis brunneis vel fusco-stramineis leviter angulatis 2.5–4 mm. diametro, vetustioribus cinereis subteretibus ad 6 mm. diametro; squamis subcoriaceis lanceolatis ad 10 mm. longis acuminatis; foliis alternatis vel apicem versus 2–4 laxe aggregatis, petiolis 10–25 mm. longis 1.5–2.5 mm. diametro; laminis coriaceis siccitate supra fusco-olivaceis subtus brunneis, oblongo- vel obovato-ellipticis, 8–13 (–14) cm. longis, 2.5–5.5 (–6.3) cm. latis, basi attenuatis vel acutis, apice gradatim acuminatis et calloso-acutis, margine recurvatis, costa supra acute impressa subtus valde prominente, nervis secundariis utrinsecus 7–12 erecto-patentibus supra leviter impressis vel haud elevatis subtus prominulis marginem versus indistincte anastomosantibus; floribus axillaribus apicem ramulorum versus ut videtur confertis, bracteis basalibus paucis papyraceis oblongis ad 10 × 8 mm. mox caducis; pedicellis sub anthesi 6–10 mm. longis et 1.4–2 mm. diametro ebracteolatis; segmentis perianthii 27–32, extimis 2 vel 3 submembranaceis oblongis ciliolatis 7–17 mm. longis et 4–7 mm. latis, maximis (5–15) membranaceis anguste ligulatis obscure ciliolatis et glandu-

losis 15–25 × 2–4 mm., interioribus eciliatis 15–21 × 1–2.5 mm. vel intimis paullo brevioribus; staminibus 21–26 plus minusve 3-seriatis, 3.2–4.7 mm. longis, filamentis ligulatis 1.3–2.5 mm. longis basi leviter contractis, antheris oblongis 1.5–2.5 mm. longis, connectivo cuspidato; carpellis sub anthesi 13 vel 14, 4–5.5 mm. longis, ovario complanato-ovoideo 1.5–2 mm. longo in stylum subulatum 2.5–3.5 mm. longum attenuato; pedicellis sub fructu haud incrassatis, carpellis maturis saepe ad 11 reductis, 16–20 mm. longis, 6–9 mm. latis, 3–4 mm. crassis in acuminem 5–6 mm. longum abrupte angustatis, semine stramineo. Fig. 6, a–g.

Type locality: Southern Yünnan; type, *Henry 10182*, cited below.

Distribution: Southern Yünnan; the Henry specimens all come from the region of the Red River, but the Forrest specimen cited below, without locality, was presumably obtained farther north in Yünnan. Superficially this Forrest specimen seems to agree with the Henry collections, but it may be merely an extreme form of *I. Simonsii*. The Henry specimens were obtained in forest at altitudes between 1650 and 2750 m. See map, *fig. 5*.

CHINA: Yünnan: South of Hsin-hsien, near Meng-tzu, *A. Henry 10182* (A type, K, NY) (Jan. 20, [year?]); Feng-chen-lin Mt., south of Red River, *A. Henry 10182A* (A, K, US), *10182B* (A, NY, US); mountains across the Red River from Meng-tzu, *A. Henry 9451* (A, K, NY), *9451A* (A, K, US); without definite locality, *G. Forrest 17820* (A, K).

Color notes: According to Henry's notes, the perianth-segments are greenish to white and the stamens are yellow. The species is in flower at least from January to March, and fruits are mature in July.

The large and numerous perianth-segments distinguish this entity from the bulk of the *I. Simonsii* complex. Its leaves also are large, and its carpels seem to be consistently numerous. Combined with its geographical isolation from the major portion of the *I. Simonsii* complex (at least as regards the Henry specimens), these characters seem to indicate specific status for *I. macranthum*.

4. **Illicium** (§ *Badiana*) **Simonsii** Maxim. in Bull. Acad. Sci. St. Pétersb. **32**: 480. 1888; King in Ann. Bot. Gard. Calcutta **3**: 201. *pl. 39, B*. 1891.

Illicium Griffithii var. *yunnanense* Franchet in Bull. Soc. Bot. Fr. **33**: 383. 1886, Pl. Delav. 32. 1889; Matsuda in Bot. Mag. Tokyo **21**: (243). 1907.

Illicium yunnanense Franchet ex Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 29. 1905 [repr. Contr. Fl. As. Or. **2**: 29. 1907]; H. Lév. Cat. Pl. Yun-Nan 174. 1916; Wilson in Jour. Arnold Arb. **7**: 238. 1926; Hand.-Maz. Symb. Sin. **7**: 245. 1931.

Illicium Fargesii Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 29. *pl. 4, A, 1–14*. 1905 [repr. Contr. Fl. As. Or. **2**: 29. 1907]; H. Lév. Cat. Pl. Yun-Nan 174. 1916; Chien, Ic. Chin. For. Trees **1**: *pl. 25*. 1937.

Illicium szechuanensis (sic) Cheng in Ic. Pl. Omeiens. **1** (1): *pl. 6*. 1942.

Shrub or tree, up to 9 m. high (rarely up to 15 m.), the young branchlets brownish, lightly angled, 2–4 mm. in diameter, at length cinereous and subterete, often considerably enlarged; bud-scales papyraceous, lanceolate, the largest ones 4–10 mm. long; leaves subopposite or alternate along the distal branchlets, sometimes in lax clusters of 3–5 at distal nodes; petioles 7–15 (–20) mm. long, 1–2.5 mm. in diameter; leaf-blades coriaceous, when dried dark green to dark olivaceous above and often pale brown beneath, lanceolate to elliptic or oblong-elliptic, (4–) 6–12.5 cm. long, (1–) 1.5–4.3 (–4.7) cm. broad, acute to attenuate at base, cuspidate or short-acuminate at apex and callose-acute, slightly recurved at margin, the costa impressed above, raised or fairly prominent beneath, the secondary nerves often obsolete, 6–10 (–12) per side, suberect, often plane or faintly raised above and prominulous beneath; flowers axillary, often appearing congested toward apices of branchlets, the subtending bracts usually 3–7, papyraceous, oblong to suborbicular-ovate, up to 6 × 6 mm.; pedicels often rugulose, 2–8 mm. long at full anthesis, 1.5–2 (–3) mm. in diameter, ebracteolate or with a single fugacious bracteole near middle; perianth-segments 18–23 (rarely to 26), the outermost 2–5 thin-papyraceous, obscurely glandular dorsally, ciliolate, elliptic-oblong, 5–11

× 4–7 mm., the largest segments membranaceous, often eciliate, oblong-lanceolate to ligulate, 9–15 (–18) mm. long and 2–4 mm. broad, the inner segments gradually narrowed, the innermost few often narrowly ligulate, 7–15 × 1–3 mm., the smallest ones sometimes much reduced; stamens 16–28, 2- or 3-seriate, 2.5–4.2 mm. long, the filaments ligulate, thin-carnose, 1–2.2 mm. long, the anthers oblong, 1.4–2.4 mm. long, the connective rounded or short-cuspidate; carpels 8–13 at anthesis, 3–4.5 mm. long, the ovary flattened-ovoid, 1.2–2 mm. long, the style subulate, sometimes stout, 1.5–2.5 mm. long; pedicels not much thickened in fruit, 5–16 (rarely 20) mm. long at full maturity, the carpels (7–) 8–13 in number, 11–20 mm. long, 6–9 mm. broad, 2.5–4 mm. thick, terminating in a subulate apex 3–7 mm. long; seed gray-brown to stramineous, 6–7 × 4–5 × 2–2.5 mm. FIG. 6, i–l.

TYPE LOCALITY: Naga Hills, Assam, India; type collected by Simons, cited by Maximowicz as "(Simons! ex hb. Calcutt.)."

DISTRIBUTION: Western Szechuan to northern and eastern Assam, at altitudes between 1800 and 3200 m.; occurring in a variety of habitats, such as mixed forest, thickets, scrub, or open places, often in valleys, along streams, or in moist gullies. See map, *fig. 5.*

CHINA: SZECHUAN: Hsi-ch'ang Hsien (Ning-yüan), *T. T. Yü 1208* (A); Hui-li Hsien, *T. T. Yü 1446* (A), *C. Schneider 569* (A, GH, K, US). YÜNNAN: Between Ta-lu and Hua-p'ing, near Yung-pai, *J. F. Rock 11725* (A, UC, US); Che-hai, *E. E. Maire 3327* (NY, UC); San-ying-p'an, *C. Schneider 415* (A, K), *H. Handel-Mazzetti 668* (K); "Hoa kiao pin, tie so," near Pai-yen-ching, *S. Tén 160* (A, US); "Sou pin chao," between Pai-yen-ching and P'ien-chiao, *S. Tén 333* (A, UC, US), *362* (A, UC); Ta-li Hsien, *C. W. Wang 63440* (A); Ta-li Range, *G. Forrest 4701* (A); Ts'ang Shan, near Ta-li, *J. M. Delavay*, Feb. 21, 1889 (K, NY); mountains of Yang-p'i River drainage basin, near Ta-li, *J. F. Rock 6247* (A, US); near Huang-lien-p'u, between T'eng-yüeh and Ta-li, *G. Forrest 4106* (A, K); Hsia-kuan, Wa-fang, *T. T. Yü 17507* (A); near Hia-fang-shao, Ts'ang Shan, between Ta-ts'ang and Hsia-kuan, *J. F. Rock 3104* (A, US); between T'eng-yüeh and Ta-li, *J. F. Rock 9616* (A, UC, US); Shweli River drainage basin and environs of T'eng-yüeh, *J. F. Rock 8003* (A, UC, US), *8018* (A, US); south of T'eng-yüeh, *G. Forrest 8127* (K); Salwin–Chiu Chiang divide, *G. Forrest 19980* (A, K); western flank of Shweli–Salwin divide, *G. Forrest 9077* (A, K); Shweli–Salwin divide, north of Ho-t'ou, *G. Forrest 26279* (A, K, NY, US); Shweli–Salwin divide, *G. Forrest 11912* (A, K, UC); "Bahanlo," Salwin Valley, *T. T. Yü 23117* (A); Si-gi-tung, Ch'ang-p'u-t'ung, *C. W. Wang 67419* (A), *67421* (A); Der-la, Ch'ang-p'u-t'ung, *C. W. Wang 66733* (A); Mt. Kenichunpo and region of Ch'ang-p'u-t'ung, *J. F. Rock 10232* (A, US); Salwin Valley, southeast of Ch'ang-p'u-t'ung, *T. T. Yü 19138* (A); "Ou-long," *E. E. Maire 289* (A, K); "Tong-tch'ouan," *E. E. Maire 381* (A); "Che-tse-lo," *H. T. Tsai 58342A* (A); without definite locality, *F. Ducloux 168* (NY, UC), *G. Forrest 9658* (A, K), *15724* (A, K), *16567* (K).

BURMA: SAGAING: Myitkyina: Northeast of Hpimaw, *Maung Po Khant 17070* (K); Hpimaw Fort, *F. K. Ward 335* (A, NY); Hpare Pass, *C. W. D. Kermode 17179* (K).

INDIA: ASSAM: Chibaon (Minutang), Delei Valley, *F. K. Ward 8050* (K); Kupra and Kunho, near Mao, Manipur, *G. Watt 6146* (K).

COLOR NOTES: The flowers, which have been noted in anthesis from February to May (rarely from the end of December to June), are often reported as fragrant; the perianth-segments are said to be predominantly pale yellow, sometimes creamy or white, very rarely pink-tinged. The fruits, which are mature from June to October, are at first green, later with a reddish or purplish tinge. I find no records of a vernacular name, either in herbaria or in literature, for this species.

SYNONYMY: The two descriptions of *I. Simonsii* and King's plate cited above permit a good understanding of the type specimen; the material which I cite from Assam would appear to be identical with this. In spite of these excellent early descriptions, the binomial has been consistently ignored in literature and in herbaria.

Illicium yunnanense, although the epithet varietally dates from 1886, was not published as a binomial until 1905. The type specimens were collected at Ts'ang Shan, near Ta-li, Yünnan, by Delavay in 1883 and 1885. The Delavay specimen from this locality which I cite above, collected in 1889, is merely a topotype.

Illicium Fargesii was based on *Farges 208* and *964,* from Szechuan. The original description and plate are ample and indicate that the concept is represented by the Szechuan

specimens above cited, which I cannot distinguish from *I. Simonsii*. It should be noted that specimens available to me as *Farges "208 bis"* do not represent the concept covered by Finet & Gagnepain's description; these specimens are elsewhere in this paper referred to *I. Henryi* var. *multistamineum*.

Illicium "szechuanensis" is typified by *Tsung 1018*, from O-pien Hsien, Szechuan. It is well described and figured and seems indistinguishable from the Szechuan specimens cited above.

The group of inland continental species of § *Badiana* offers considerable taxonomic difficulty. Geographically this complex is limited to the region from Szechuan to Assam, centering in Yünnan. It is distinguished from the insular and coastal Asiatic species of § *Badiana* primarily by its short pedicels (except for *I. manipurense*), and in addition certain aspects of leaf-shape, apex, and venation make the separation of the inland from the insular components of § *Badiana* comparatively easy. The rather artificial separation of *I. manipurense* from the *I. Simonsii* complex is discussed under that species.

The foliage of the *I. Simonsii* complex is not very variable, and no important characters are offered by the size, texture, or venation of leaf-blades, except that the blades of *I. burmanicum* have somewhat unusual venation. A character usually fairly dependable in *Illicium*—number of carpels—is almost useless in this complex, as flowers from the same specimen may vary greatly in this respect, numbers from 9 to 13 having been found on the same individual. Certain individuals seem to have consistently 8 carpels, and others 12 or 13.

A few reasonably clear groups within the complex may be delimited as follows:

(1). Certain specimens from northern Burma which have the secondary nerves more obvious than usual, irregularly spreading, and copiously anastomosing; perianth-segments said to be whitish purple, whereas the rule in this complex is for white to yellow segments; outermost perianth-segments rather large but not extreme in dimensions; anthers somewhat larger than average; carpels 8–12. This segregate I maintain as *I. burmanicum*.

(2). Specimens from northern Burma characterized primarily by their numerous stamens (28–35), whereas elsewhere in the complex they are fewer than 28 and average about 18–25; perianth-segments numerous (27–30); anthers somewhat larger than average; perianth-segments sometimes pink-tinged; carpels 12 or 13. This segregate is described above as a new species, *I. Wardii*.

(3). A group of specimens from southern Yünnan characterized by numerous perianth-segments (27–32) which in size are clearly the largest in the complex, the larger ones being 15–25 mm. long, whereas elsewhere a maximum length of 18 mm. is only rarely exceeded; carpels consistently numerous (13 or 14); habit and foliage fairly robust. I designate this segregate as a new species, *I. macranthum*.

(4). A specimen from southern Yünnan characterized by its slender habit (as regards petioles, pedicels, etc.) and especially by a small number of stamens (12 or 13), elsewhere in the complex a minimum of 16 being observed, the average number being perhaps 18–25; perianth-segments comparatively few and small; anthers small; carpels 8 (but only one collection available). This specimen, also, was obtained south of the main range of the complex, and I describe it below as *I. Tsaii*.

(5). I find no satisfactory method of further dividing the residue of material in the *I. Simonsii* complex. The leaf-blades of this residue vary in shape from fairly broadly elliptic to lanceolate, but this variation appears to have no geographical basis, although most of the specimens from northwestern Yünnan may

on the whole have slightly the broadest leaves and may be most similar to the typical form from Assam. These specimens from northwestern Yünnan also agree fairly well in having 10–13 carpels. Specimens with fewer carpels (8–10) are perhaps most prevalent in west-central Yünnan (region of Ta-li, T'eng-yüeh, etc.) and Burma, and these specimens are occasionally characterized by small leaves. It should be noted, however, that the historical material of *I. yunnanense,* from the vicinity of Ta-li, combines narrow leaves with a large number of carpels (reported as 10–14). Specimens from Szechuan, including the types of *I. Fargesii* and *I. "szechuanensis,"* have 11–13 carpels and appear in no way to differ

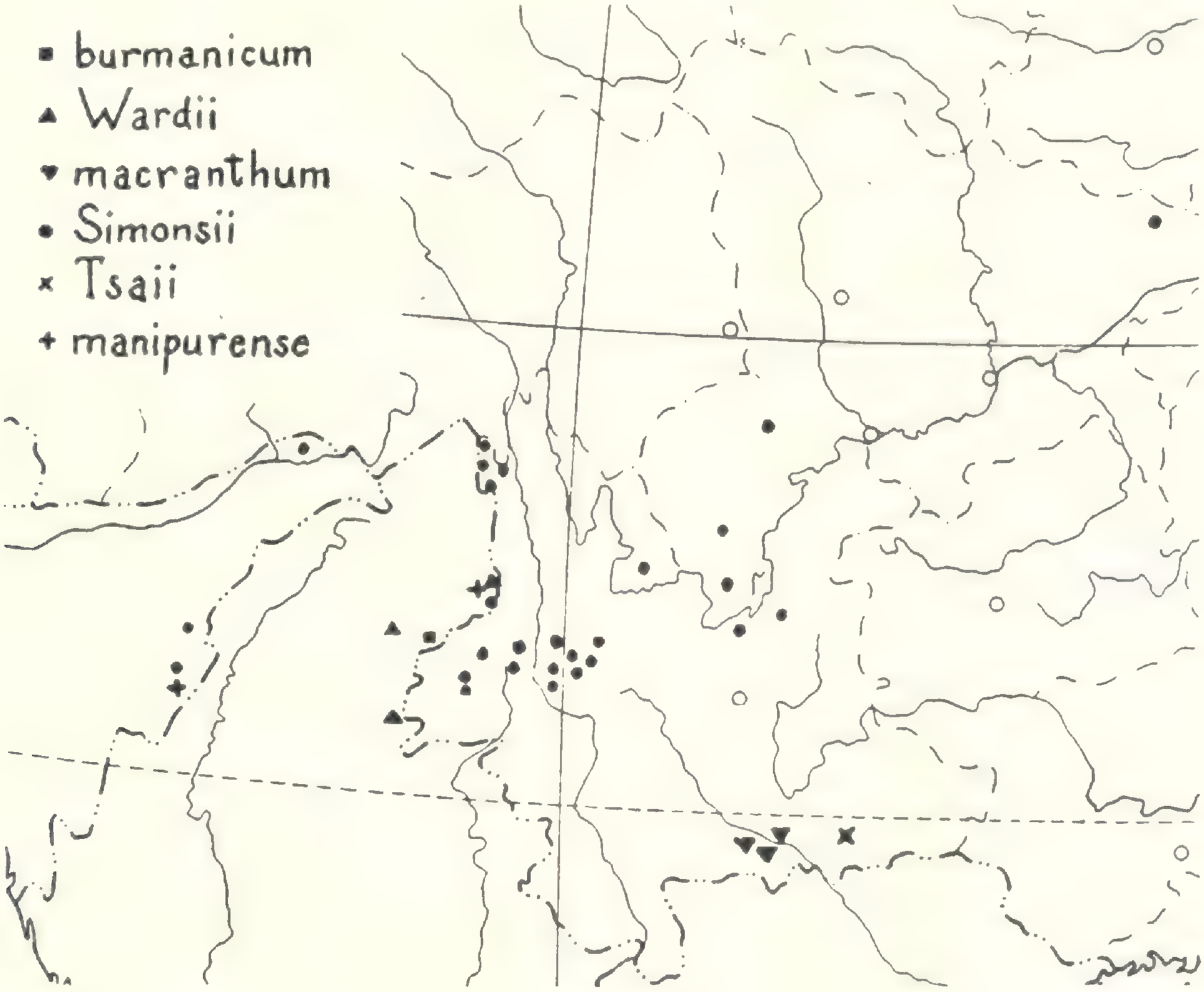

FIG. 5. Approximate known distribution of *Illicium burmanicum, I. Wardii, I. macranthum, I. Simonsii, I. Tsaii,* and *I. manipurense.*

from typical *I. Simonsii.* In regard to the unreliability of carpel-number in this complex, it should be mentioned that certain specimens (*Maire 289, Tén 333*) were observed to have 9–13 carpels in different flowers of the same sheet. A phenomenon is observed in *Rock 9616* which is not found elsewhere in *Illicium*—the presence of small scales subtending each individual stamen. These scales are membranous, oblong, 1.5–2 mm. long, subacute and sometimes bifid at apex; their presence is not accompanied by any other unusual characteristics, and the specimen otherwise agrees with other material from the same region.

It is unfortunate that four binomials—namely *I. Simonsii, I. yunnanense, I. Fargesii,* and *I. "szechuanensis"*—seem to fall into the indivisible residue of this

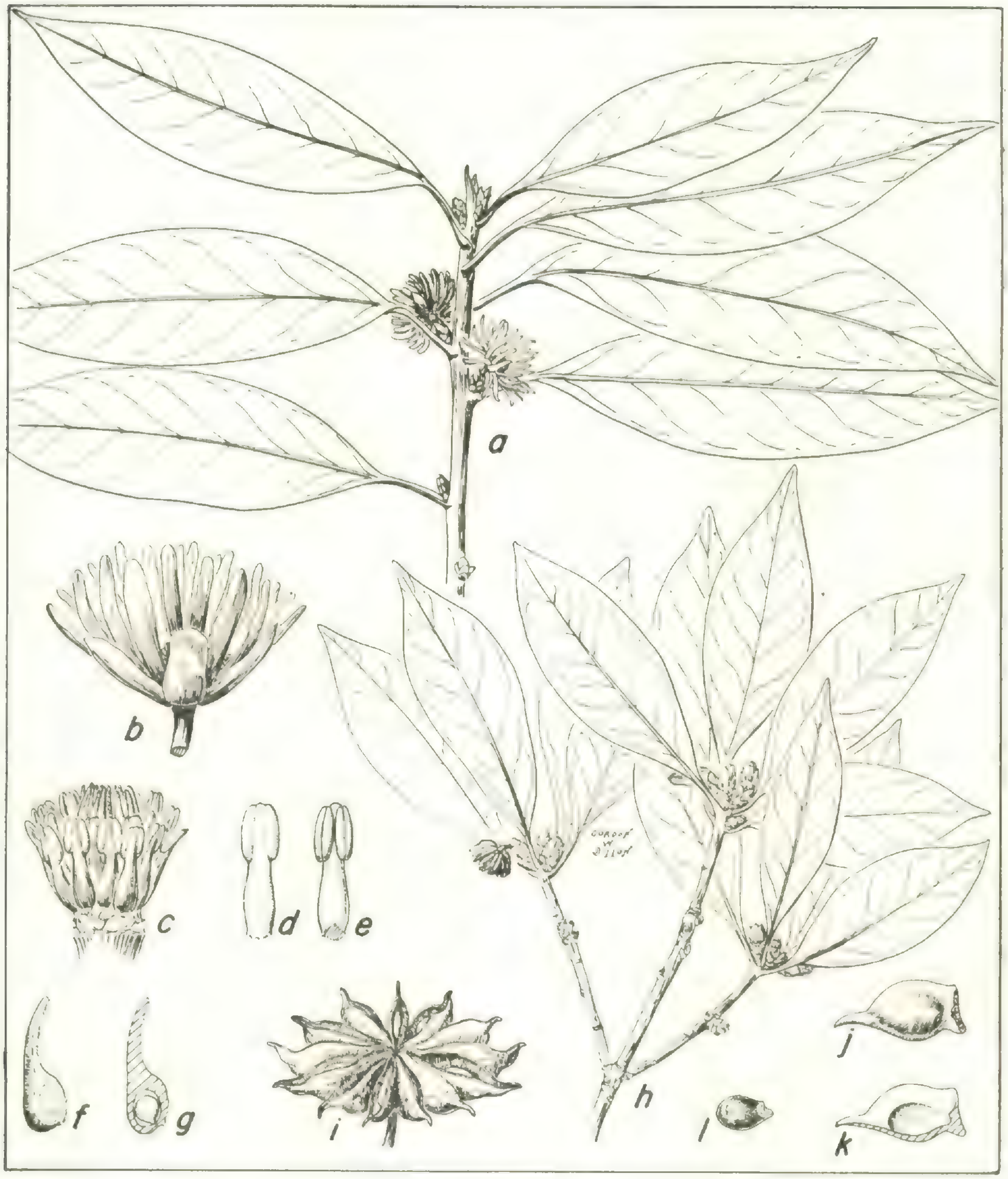

FIG. 6. *Illicium* § *Badiana*. *a–g*. *I. macranthum*: *a*. flowering branchlet, × ½; *b*. flower, × 1; *c*. flower with perianth-segments removed, × 3; *d*. stamen, extrorse view, × 4; *e*. stamen, introrse view, × 4; *f*. carpel, × 4; *g*. longitudinal section of carpel, × 4. *h*. *I. philippinense*: flowering branchlet, × ½. *i–l*. *I. Simonsii*: *i*. fruit, × 1; *j*. mature carpel, × 1; *k*. longitudinal section of carpel, × 1; *l*. seed, × 1. *Fig. a* drawn from *Henry 9451A*; *b–g* from *Henry 10182*; *h* from *Vanoverbergh 3353*; *i–l* from *Rock 10232*.

complex, whereas three of the segregate groups appear to have no available names and are therefore described as new species. However, these reductions and proposals seem to offer the only legitimate solution to this problem on the basis of present material, unless the entire complex is left as a variable unit under the binomial *I. Simonsii*. Future students may find another and better solution for this problem.

5. **Illicium** (§ *Badiana*) **Tsaii** sp. nov.

Frutex ad 3 m. altus, ramulis gracilibus, hornotinis rugulosis subteretibus brunneis circiter 2 mm. diametro, vetustioribus cinerascentibus; foliis alternatis apicem ramulorum versus subaggregatis, petiolis gracilibus (circiter 1 mm. diametro) 10–13 mm. longis; laminis subcoriaceis in sicco fusco-olivaceis, oblongo-lanceolatis, (5–) 6–9 cm. longis, (1.5–) 2–3 cm. latis, basi acutis, apice gradatim acuminatis et saepe calloso-apiculatis, margine leviter recurvatis, costa supra obscure impressa subtus valde elevata, nervis secundariis utrinsecus 6–8 erecto-patentibus utrinque haud prominulis saepe obsoletis; floribus apicem ramulorum versus axillaribus, bracteis basalibus paucis papyraceis suborbicularibus 3.5–4 mm. longis latisque; pedicellis gracilibus 1–1.2 mm. diametro sub anthesi 2.5–4 mm. longis ebracteolatis; segmentis perianthii 16–19, extimis 3 papyraceis oblongis ciliolatis 6–7 × 2.5–4.5 mm., maximis (7–10) membranaceis anguste oblongo-ellipticis 8–12 × 2.5–4.5 mm. subciliolatis, intimis (3–9) lanceolato-ligulatis eciliatis subacutis 7–12 × 1.5–3 mm.; staminibus 12 vel 13 plerumque uniseriatis 2.8–4 mm. longis, filamentis ligulatis papyraceis 1.3–2.7 mm. longis, antheris oblongis 1.2–1.5 mm. longis, connectivo obtuse cuspidato; carpellis sub anthesi 8, 3–4.5 mm. longis, ovario complanato-ellipsoideo 1.2–1.8 mm. longo in stylum subulatum omnino stigmatiferum 1.8–2.8 mm. longum producto.

TYPE LOCALITY: Southern Yünnan; type, *Tsai 51754,* cited below.

DISTRIBUTION: Known only from the type collection, collected in woodland at an altitude of 1800 m. See map, *fig. 5.*

CHINA: YÜNNAN: Wen-shan Hsien (K'ai-hua), *H. T. Tsai 51754* (A TYPE), Feb. 11, 1933.

COLOR NOTES: The flowers are said to be white and are approaching anthesis on the date mentioned above.

As noted in the discussion under *I. Simonsii,* this entity seems to merit specific recognition for its slender habit, comparatively small flowers, and few stamens; it occurs to the south of the range of *I. Simonsii.*

6. **Illicium** (§ *Badiana*) **manipurense** Watt ex King in Ann. Bot. Gard. Calcutta **3:** 200. *pl. 40, B* (as *I. munipurense*). 1891; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 29. 1905 [repr. Contr. Fl. As. Or. **2:** 29. 1907].

Shrub to 2 m. high (or small tree?), the branchlets slender (2.5–4 mm. in diameter), rugulose, brownish, slightly angled when young, at length subterete; bud-scales papyraceous, oblong, the largest ones up to 15 mm. long; leaves alternate, or 3 or 4 clustered at distal nodes; petioles 12–18 mm. long, about 1.5 mm. in diameter; leaf-blades coriaceous, brown or olivaceous when dried, lanceolate-oblong or ovate-elliptic, 7–11 cm. long, 2–4.3 cm. broad, acute at base, gradually acuminate to a callose-mucronulate apex, narrowly recurved at margin, the costa sharply impressed above, prominent beneath, the secondary nerves 6–9 per side, spreading, faintly impressed or subplane above, slightly raised beneath; flowers axillary, the subtending bracts papyraceous, oblong, up to 6 mm. long; pedicels faintly rugulose, slender, 0.8–1.5 mm. in diameter, 16–25 mm. long at anthesis, apparently ebracteolate; perianth-segments 22–24, membranaceous, the outermost 3 oblong, ciliolate, 9–14 × 2–5 mm., the largest ones (7 or 8) ligulate, eciliate, 13–18 × 2–4 mm., the inner ones ligulate to lanceolate, gradually reduced, the innermost 2 often subulate, 5–9 × 1.5–2 mm.; stamens 17–19, about 2-seriate, 2.5–3.3 mm. long, the filaments thin-carnose, obovate-ligulate, 1–1.7 mm. long, the connective truncate or faintly cuspidate, the thecae 1.4–1.7 mm. long; carpels 7 or 8 (in flowers examined; sometimes 9?), 4–5 mm. long at anthesis, the ovary flattened-ellipsoid, 1.5–2 mm. long, the style subulate, 2.5–3 mm. long; fruiting specimens not seen.

TYPE LOCALITY: Manipur–Burma frontier region; type, *Watt 6585,* in the Calcutta herbarium, of which a duplicate is cited below. No number is mentioned in the original publi-

cation, but data on the sheet make it obvious that no. *6585* is the sole basis of King's description.

DISTRIBUTION: Northern Burma and adjacent Assam, at altitudes of 2100–2700 m. See map, *fig. 5*.

BURMA: SAGAING: Myitkyina: Laikam–Humyetaung Road, *C. W. D. Kermode 17095* (K).

INDIA: ASSAM: Keyang and Ching Sow, on the Manipur–Burmese frontier, *G. Watt 6585* (TYPE COLL., K), Apr. 21, 1882.

COLOR NOTES: Both specimens cited are in full anthesis and were collected in April; Kermode notes the flowers as yellow-green.

On the basis of the material of § *Badiana* now available from western China, Burma, and Assam, it seems impossible properly to evaluate the entities in the *I. Simonsii* complex, including *I. manipurense*. An adequate understanding of this complex must probably await extensive field study and perhaps genetic analysis. The groups proposed in the present treatment are established without much confidence in their fundamental value. For instance, *I. manipurense* seems distinguishable primarily on the basis of its comparatively long pedicels, narrow perianth-segents, etc. A specimen from Burma not elsewhere cited by me (*Kermode 17310* [K], from Myitkyina District, between Kangfang and Tang-tung) has the long pedicels characteristic of *I. manipurense,* but its perianth-segments are comparatively broad and are said to be "deep flesh pink," in which respects it is suggestive of some sheets of *I. Wardii;* its carpels are about 12 and longer than typical in *I. manipurense*. I am at a loss to place such a specimen as *Kermode 17310,* which may represent a hybridization between *I. manipurense* and *I. Wardii,* if indeed these entities are worthy of removal from the *I. Simonsii* complex, which for the time being seems to present an insoluble problem.

7. **Illicium** (§ *Badiana*) **anisatum** L. Syst. Nat. ed. 10, 1050. 1759, Sp. Pl. ed. 2, 664, p. p. 1762, Syst. Nat. ed. 12, **2**: 335. 1767; Hill, Hort. Kew. *227*. 1769; L. Mant. 395. 1771; Murr. Syst. Veg. ed. 13, *422*. 1774, ed. 14, 507. 1784; Lam. Encycl. Méth. Bot. **1**: 351, p. p. 1783; Thunb. Fl. Jap. 235. 1784; Vitman, Summa Pl. **3**: 336, p. p. 1789; J. F. Gmel. Syst. Nat. **2**: 867, p. p. 1791; Lam. Rec. Pl. Bot. **2**: *pl. 493, fig. 2, a–f.* 1797; Vent. Tabl. Reg. Vég. **3**: 71. 1799; Willd. Sp. Pl. **2**: 1254. 1800; Pers. Syn. Pl. **2**: 93. 1806; Roques, Pl. Usuelles Indig. et Exot. **1**: 44. *pl. 18, fig. 26.* 1807; Chaumeton, Fl. Med. **1**: *pl. 30.* 1814; DC. Reg. Veg. Syst. Nat. **1**: 441, p. p. 1817; Link, Enum. Pl. **2**: 86. 1822; Lam. Tabl. Encycl. **3**: 37. 1823; DC. Prodr. **1**: 77, p. p. 1824; Spreng. Syst. Veg. **2**: 643, p. p. 1825; Nees, Pl. Offic. *pl. 371.* 1828; G. Don, Gen. Syst. **1**: 79, p. p. 1831; Link, Handb. **2**: 374. 1831; Hayne, Getreue Darst. Arzn. Gewächse **12**: *pl. 29.* 1833; de Vriese in Tijdschr. Nat. Gesch. **1**: 38. *pl. 2, fig. a, 1–24.* 1834, in op. cit. **3**: 119. 1836; Brandt in Bull. Sci. Acad. Sci. St. Pétersb. **3**: 90. 1837; Loudon, Arb. et Frut. Brit. **1**: 257, p. p. 1838; Walp. Rep. Bot. Syst. **1**: 72. 1842; Dietr. Syn. Pl. **3**: 310, p. p. 1843; Cassone, Fl. Med.-Farm. **1**: 101. *tab. 32* (excl. *figs. 5–8*). 1847; Miq. in Ann. Mus. Bot. Lugd.-Bat. **2**: 257. 1866; Baill. Hist. Pl. **1**: 153. *figs. 195–199.* 1868–69; Franch. & Sav. Enum. Pl. Jap. **1**: 15. 1873; Hemsl. in Garden **8**: *270*. 1875; Artus, Hand-Atlas Med.-Pharm. Gewächse 11. *pl.* (excl. *figs. 4–6*). 1876; Bentley & Trimen, Med. Pl. **1**: *pl. 10* (excl. *figs. 6–10*). 1880; Ito, [Pl. Koishikawa Bot. Gard.] **1**: *pl. 6.* 1884; Nichols. Ill. Dict. Gard. **2**: 177. 1885; Prantl in E. & P. Nat. Pfl. III. **2**: 18. *fig. 17, B–D.* 1888; Karsten, Fl. Deutsch. **2**: 113. *fig. 392* (*1, 5–8*). 1895; Parment. in Bull. Sci. Fr. & Belg. **27**: *221, 296*. 1896; Ohno in Bot. Mag. Tokyo **14**: (41). 1900; Bailey, Cycl. Am. Hort. **2**: 799. 1900; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 28. 1905 [repr. Contr. Fl. As. Or. **2**: *28*. 1907]; Schneid. Ill. Handb. Laubholzk. **1**: 328. 1905, **2**: 925., *fig. 577.* 1912; Matsuda in Bot. Mag. Tokyo **21**: (243). 1907; Shirasawa, Ic. Ess. For. Jap. **2**: *tab. 17, figs. 6–17.* 1908; Tokubuchi in Miyabe-Festschr. 321. 1911; Matsum. Ind. Pl. Jap. **2** (*2*): 93, p. p. 1912; Silva Tarouca, Freil.-Laubgeh. *240*. 1913; Bailey, Stand. Cycl. Hort. **3**: 1641. 1915; Auct.? in Jour. Jap. Bot. **1**: (255). *fig.* (p. 258). 1918; Bean, Trees and Shrubs Brit. Isles ed. 3. **1**: 653. 1921; Mori, Enum. Pl. Corea 165. 1922; Nakai, Fl. Sylv. Koreana **20**: 111. *tab. 22.* 1933; Burkill, Dict. Econ. Prod. Mal. Penins. 1225. 1935; Sugimoto, Key Trees and Shrubs Japan 86. 1936.

Somo, vulgò Skimmi, Fanna Skimmi & Fanna Skiba Kaempf. Amoen. Exot. 880. *fig.* 1712.

Anisum stellatum Chaumeton, Fl. Med. **1:** *pl. 30,* as synonym. 1814; Cassone, Fl. Med.-Farm. **1:** 101, as synonym. 1847.

Anisum peregrinum Bauhin ex Chaumeton, Fl. Med. **1:** *pl. 30,* as synonym. 1814; Cassone, Fl. Med.-Farm. **1:** 101, as synonym. 1847.

Illicicium (sic) *Japonicum* Sieb. in Verh. Batav. Gen. **12:** 50. 1830.

Illicium religiosum Sieb. & Zucc. Fl. Jap. **1:** 5. *tab. 1.* 1835; Spach, Hist. Nat. Veg. **7:** 441. 1839; Walp. Rep. Bot. Syst. **1:** 72. 1842; Hook. in Curtis's Bot. Mag. **69:** *pl. 3965.* 1842; Hayne, Getreue Darst. Arzn. Gewächse *pl. 19.* [1843]; Lem. in Herb. Gén. Amat. II. **4:** *pl. 27.* 1844; Hassk. Cat. Pl. Hort. Bot. Bog. 178. 1844; Sieb. & Zucc. in Abh. Bayer. Akad. Wiss. Math. Phys. Cl. **4** (2): 185. 1845; Maund, Bot. Garden **12:** no. 1086. *pl. 272.* 1847; Berg & Schmidt, Darst. und Beschr. Offiz. Gewächse *pl. 30f, A–L.* 1863; Baill. Hist. Pl. **1:** 153. 1868–69; Anon. in Gard. Chron. n. ser. **9:** 656. *fig. 120.* 1878; Prantl in E. & P. Nat. Pfl. III. **2:** 18. 1888; Dippel, Handb. Laubholzk. **3:** 158. *fig. 83.* 1893; Tanaka, Useful Pl. Jap. 124. 1895; Parment. in Bull. Sci. Fr. & Belg. **27:** 221, 295. 1896; De Wildem. Ic. Sel. Hort. Then. **4:** 25. *pl. 126.* 1903; Koorders, Exkursionsfl. Java **2:** 244. 1912; Bean, Trees and Shrubs **1:** 653. 1914; Wayland in Garden **81:** 232. *fig.* 1917; Nakai in Bot. Mag. Tokyo **36:** 119. 1922; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936.

Illicium anisatum α *genuinum* Baill. in Adansonia **8:** 12. 1867.

Illicium anisatum β *religiosum* Baill. in Adansonia **8:** 12. 1867.

Badianifera anisata Kuntze, Rev. Gen. Pl. **1:** 6. 1891.

Illicium anisatum var. *rosea* (sic) Makino in Jour. Jap. Bot. **3:** 15. 1926.

Illicium religiosum var. *rosea* (sic) Makino in Jour. Jap. Bot. **5:** 17. 1928; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936.

Illicium anisatum var. *roseum* Makino ex Sugimoto, Key Trees and Shrubs Japan 86. 1936.

Shrub or small tree, usually not exceeding 8 m. in height, the branchlets slender, when young brownish, lightly angled or striate-rugulose, 1.5–3 mm. in diameter, at length often cinerascent and subterete, somewhat thicker; bud-scales papyraceous, ovate-oblong, the largest ones usually not exceeding 7 mm. in length; leaves irregularly alternate toward apices of branchlets or in lax clusters of 3–5 at distal nodes; petioles narrowly winged distally, 7–20 mm. long, 1–2 mm. in diameter; leaf-blades coriaceous, when dried usually dark olivaceous above and pale brown beneath, prevailingly narrowly obovate but sometimes elliptic or lanceolate-elliptic, (4–) 5–12 cm. long, (1.5–) 2–4 (–4.7) cm. broad, attenuate at base, obtuse to cuspidate or short-acuminate at apex (actual apex usually obtuse), narrowly recurved at margin, the costa elevated or nearly plane above, elevated but not very prominent beneath, the secondary nerves usually 4–6 per side, ascending, slightly elevated or prominulous on both sides (sometimes nearly plane, rarely obscure), the anastomoses inconspicuous; flowers axillary, often crowded toward apices of branchlets, the subtending bracts several, papyraceous, oblong-ovate, up to 5 × 4 m.; pedicels slender (1–2 mm. in diameter), often rugulose, 4–33 mm. long at full anthesis, ebracteolate or with 1 or 2 obscure bracteoles; perianth-segments 17–24, the 2–6 outermost ones papyraceous to membranaceous, suborbicular to oblong, usually 4–6 × 3–6 mm., sometimes up to 12 mm. long, the next few transitional, the largest segments (often 14–16 in number) membranaceous, linear-oblong to oblong-obovate, sometimes obscurely ciliolate, 11–23 × 2–4.5 mm., the few innermost ones reduced, often lanceolate, 7–10 × 1.5–2 mm., rarely transitional toward stamens; stamens 17–25, usually 2-seriate, oblong, 2.5–3.5 mm. long, the filaments carnose, ligulate, 1.2–2 mm. long, the connective obtuse to faintly emarginate, the thecae protuberant, 1–1.7 mm. long; carpels usually 8, rarely 9 or 10, at anthesis 3.5–5.5 mm. long, the ovary flattened-ellipsoid, 1.2–2.3 mm. long, the style subulate, 2.2–4 mm. long, usually recurved distally;

fruiting pedicel only slightly enlarged, the carpels usually 8, some frequently undeveloped, the mature ones 12–15 mm. long, 7–9 mm. broad, 3–6 mm. thick, abruptly cuspidate into an acumen 2–4 mm. long; seeds brown, comparatively large, 6.5–8 × 4–5.5 × 3–4.5 mm.

TYPE LOCALITY: In the original place of publication of the binomial *I. anisatum*, Linnaeus gives only a single reference, to Kaempfer's work of 1712, cited above. The species is therefore based exclusively upon Kaempfer's discussion and plate, which definitely pertain to the common Japanese species.

DISTRIBUTION: Japan (central Honshu and Oki Island southward to Yakushima) and islands off the coast of southern Korea. Notes as to habitat and altitude are singularly lacking in both herbaria and literature, but a few labels mention elevations of 100–1000 m. See map, *fig. 7*.

JAPAN: Without other locality: *F. Siebold*, in 1842 and 1843 (GH, K), *Buerger* (GH, K, NY), Herb. A. Gray (NY), *H. Shirasawa* (A), *Collector?*, June 20, 1927 (UC). HONSHU: Ibaraki Pref.: Mt. Tsukuba, *H. Takeda 208* (K); Chiba Pref.: Back of Amatsu, *R. K. Beattie & Y. Kurihara 10355* (US); Saitama Pref.: Titibu [Musashi Prov.], *Collector? 21* (US); Katayama [Musashi Prov.], *H. J. Elwes & K. Watanabe*, Apr. 1, 1895 (K); Tokyo Pref.: Ikegami, Ebara-gun, *R. K. Beattie & Y. Kurihara 10474* (US); Kanagawa Pref.: Yokohama, *C. Maximowicz*, in 1862 (GH, K, M, US); Yokosuka, *L. Savatier 45* (K, US); Shizuoka Pref.: Mt. Amagi, *Collector?* [*K. Sakurai?*], Apr. 17, 1910 (US), *K. Sakurai*, Apr. 11, 1912 (A); Mt. Akiha, *Collector?*, Mar. 24, 1888 (K); Shimoda, *Perry's Exped.*, May 1854 (US); Nagano Pref.: Narai, *J. G. Jack*, Sept. 3, 1905 (A, GH); Gifu Pref.: [Mino Prov.], *K. Shiota 4434* (A), *7296* (A), *8553* (A); Wakayama Pref.: [Kii Prov.], *G. Masamune*, Apr. 1925 (NY); Pref.?: Kingu, *H. Mayr*, Mar. 27, 1886 (A). OKI: No specimens seen, but listed from this island by Tokubuchi in 1911. SHIKOKU: Kochi Pref.: Sakawa, *T. Makino*, May 6, 1885 (type coll. of *I. anisatum* var. *"rosea,"* UC); Nanokawa, *Collector?*, Mar. 26, 1894 (US). KYUSHU: Fukuoka Pref.: Mt. Kyûhôman, Dazaifu, *T. Tanaka 183* (A, UC); Mt. Hôman, *K. Ichikawa 183* (A); Mt. Kosho, *R. Kanehira*, Oct. 1925 (US); Mt. Aburuyama, *M. Takenouchi 1074* (US); Nagasaki Pref.: Nagasaki, *C. Maximowicz*, Mar. 13–25, 1863 (GH, K, M, US), *R. Oldham 522* or in 1862 (Ch, GH, K, NY), *U. Faurie 15687* (K); Kagoshima Pref.: Mt. Kirishima, *E. H. Wilson 6189* (A, K), *10341* (A), *Z. Tashiro*, Aug. 18, 1917 (A); Shigetomi, Satsuma Pen., *E. H. Wilson 6170* (A, GH, K, M, US). YAKUSHIMA: *E. H. Wilson 6061* (A, K, M, US), *G. Masamune*, July 26, 1927 (NY).

KOREA: QUELPAERT I.: "Secus torrentes Yelloi," *T. Taquet 838* (A, K); "secus torrentes Mokatji," *T. Taquet 839* (A, K); "in silvis Poptjyongi," *T. Taquet 2594* (A).

CULTIVATED: *U. Faurie 3832* (UC) (Sendai, Miyogi Pref., Honshu); *J. Matsumura*, July 1879 (US) (Tokyo); Herb. Univ. Tokyo, Apr. 10, 1886 (A, M) (Bot. Gard. Tokyo); *C. S. Sargent*, Oct. 8, 1892 (A) (Agric. Coll. Tokyo); *P. H. Dorsett & W. J. Morse 119* (US) (Bot. Gard. Tokyo); *U. Faurie 7727* (K) (Public garden, Shizuoka); *C. S. Sargent*, Feb. 12, 1880 (A) (Charleston, S. Car.); *A. Eastwood*, Mar. 1914 (US) and Aug. 1916 (A) (Golden Gate Park, San Francisco); *E. G. Loder*, Oct. 29, 1918 (K) (Leonardslee, Horsham, England); *R. N. Parker*, Dec. 31, 1903 (A) (Caledonia Nursery, Guernsey); Hort. Bot. Berlin, in 1896 (A); *C. Baenitz*, Apr. 28, 1905 (A, GH, US) (Locarno, Switzerland); G. Vasey, in 1880 (US) ("greenhouse").

LOCAL NAMES, USES, and COLOR NOTES: *Shikimi*, with variants, is the common Japanese name for this species. Other names recorded in Japan are: *Hananoki, Koshiba* (by Matsumura), and *Hanashiba* (by Tanaka). Nakai records the Korean names as *Parugack* and *Chôrukupuri*.

In much of the literature this species has been confused with the later-described *I. verum*, and the uses of the latter are commonly ascribed to *I. anisatum*. Actually, the Japanese species has poisonous properties and is the source of an alkaloid, skimmianine (see Burkill in 1935, cited above, for discussion). *Illicium anisatum* was commonly grown around temples in Japan, and wreaths and branches from it were placed over tombs. The fragrant bark and seeds were sometimes used as incense. The pulverized bark burns very evenly and was sometimes so burned in graduated glass tubes by watchmen, to enable them to mark the passage of time.

The flowers of *I. anisatum* are reported as fragrant or even spicy, with perianth-segments white to yellow (at least the inner ones usually yellowish). The plants are in anthesis from

March to June, or in February on Yakushima. Mature fruits have been collected from August to October.

SYNONYMY: As mentioned above, in the paragraph concerning the type locality, Linnaeus' species is based upon a single reference and therefore there can be no confusion as to his original concept. Subsequently Linnaeus and other writers extended this concept to include Chinese material (probably *I. verum*), and for this reason some authors have attempted to exclude the name as a "nomen confusum." Without attempting to analyze the historical complications of this situation, it may be stated that Siebold and Zuccarini, in introducing the binomial *I. religiosum* for the Japanese element, did so without adequate reason. Their species is clearly a direct synonym of Linnaeus', based on Kaempfer's treatment. The often repeated statement that this species was introduced into Japan from China is quite without foundation.

"Illicicium" Japonicum Sieb. is based upon a brief note which indicates that the common Japanese species was concerned.

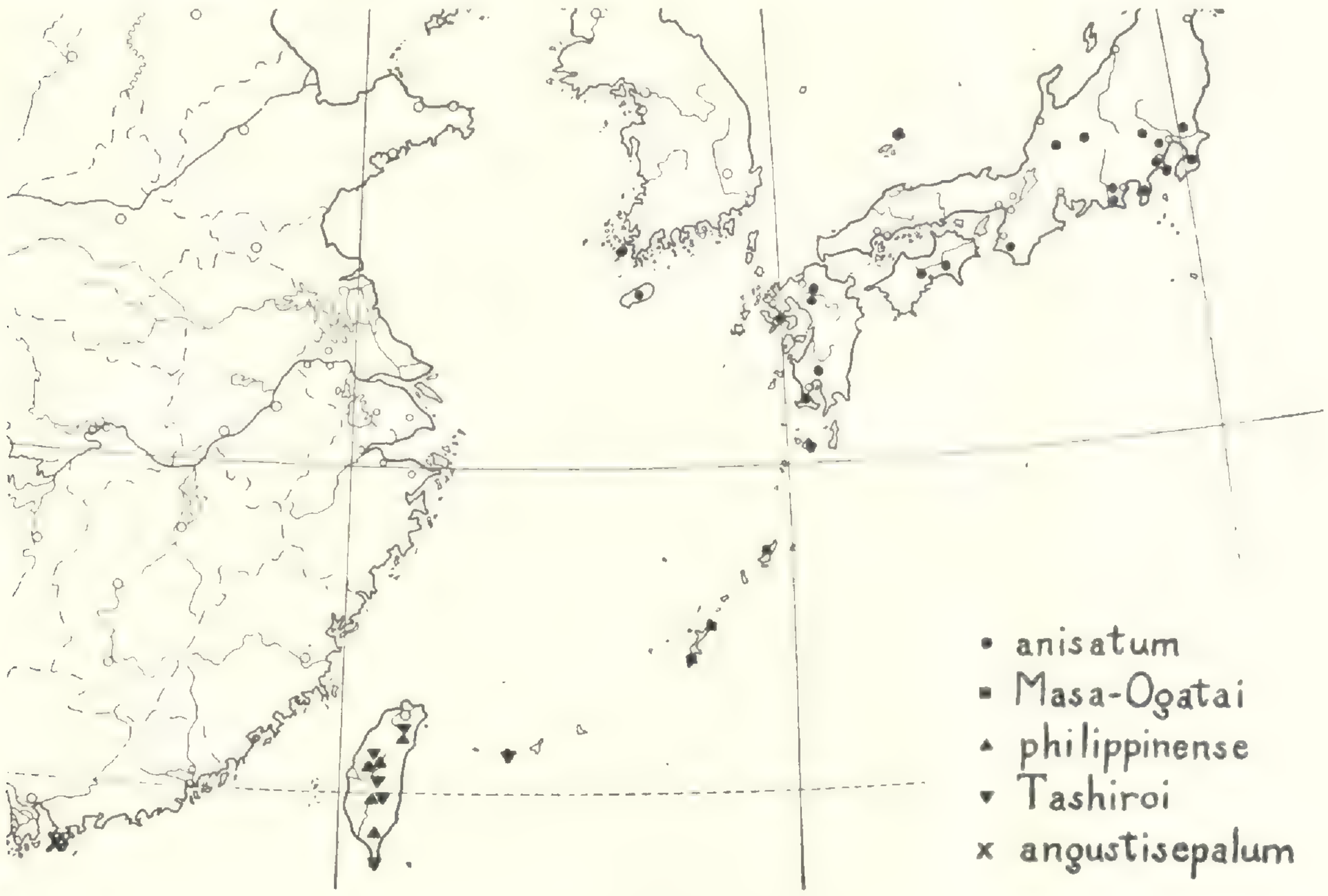

FIG. 7. Approximate known distribution of *Illicium anisatum, I. Masa-Ogatai, I. philippinense* (Formosan specimens; for Philippine specimens see *fig. 9*), *I. Tashiroi,* and *I. angustisepalum.*

Baillon's attempt to divide this entity into two varieties appears to have been inspired merely by a desire to keep alive the epithet *"religiosum."*

Illicium anisatum var. *"rosea"* is based upon a collection by Makino from Shikoku (cited above). No reasons for the proposal of the variety are given, except perhaps for the statement "outer perianth rosy." The specimen appears quite typical of *I. anisatum.*

The complex in § *Badiana* extending from Korea and central Honshu southward along the Ryu Kyu Islands to Formosa and the Philippines is taxonomically difficult. The various geographical elements of this population are generally recognized as distinct species, but examination of an extensive series of material inclines one to question this disposition. The most obvious division appears to be on the basis of carpel-number—a character which is fairly reliable in most entities in *Illicium* but which, as noted elsewhere, cannot be used with any satisfaction in such a species as *I. Simonsii.* Using this criterion for the insular popu-

lation of § *Badiana,* one is able to remove *I. Tashiroi* (including *I. randaiense*) on the basis of its 12 or 13 carpels. The remaining elements of the insular population have quite uniformly 8 carpels per flower, although a few flowers with 7–10 carpels have been observed.

On the basis of extremely tenuous characters pertaining to leaf-shape, leaf-apex, number and direction of secondary nerves, number and color of perianth-segments, and number of stamens, the insular population of § *Badiana* with prevailingly 8 carpels is divisible into three geographical segments: (1) the specimens from Korea, Honshu, Shikoku, Kyushu, and Yakushima, referable to *I. anisatum;* (2) the specimens from the central Ryu Kyu Islands, referable to *I. Masa-Ogatai* if deemed worthy of specific recognition; and (3) the specimens from Formosa and the Philippines, referable to *I. philippinense* (including *I. montanum, I. leucanthum,* and *I. daibuense*). In my key to species these three elements are separated on unsatisfactory and overlapping characters pertaining to gross morphology.

The separation of the population here discussed into three species receives some support from study of morphological details. Thus, Prof. Bailey has found that *I. Masa-Ogatai* has abundant diffuse foliar sclereids and comparatively large stomata, whereas *I. anisatum* and *I. philippinense* have the sclereids absent (or present only along the midrib) and the stomata comparatively small. Another noteworthy character is the presence or absence of oil-cells in the endothecium of the anthers. Dr. Nast has found that such oil-cells occur in *I. philippinense* but are lacking in *I. anisatum* and *I. Masa-Ogatai.* It would appear, therefore, that combinations of minute morphological characters support the unsatisfactory characters of gross morphology in such a way that three geographical entities can be set up; in the present treatment these entities are recognized as species.

8. **Illicium** (§ *Badiana*) **Masa-Ogatai** (Makino) comb. nov.

Illicium religiosum var. *Masa-Ogatai* Makino in Jour. Jap. Bot. **4**: 5. *fig. 1.* 1927; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936.

Illicium Masa-Ogatai Makino in Jour. Jap. Bot. **4**: 5, as synonym. 1927.

Illicium anisatum sensu Sasaki, Cat. Gov. Herb. (Taihoku) 215. 1930; non L.

Small tree, the branchlets rugulose, when young brownish and slightly angled, 1.5–3 mm. in diameter, soon cinerascent and subterete, up to 5 mm. in diameter; bud-scales several, papyraceous, oblong-lanceolate, up to 10 mm. long; leaves in lax clusters of 3–6 at distal nodes; petioles distally winged, 7–15 mm. long, 1–2 mm. in diameter; leaf-blades coriaceous, olivaceous on both sides or pale brown beneath, lanceolate or obovate-lanceolate, 4.5–8 cm. long, 1.2–3.5 cm. broad, attenuate at base, gradually narrowed to a cuspidate or short-acuminate apex (actual apex obtuse or subacute, slightly callose-thickened), narrowly revolute and callose-thickened at margin, the costa slightly raised or nearly plane above, raised but not prominent beneath, the secondary nerves about 4 per side, ascending, faintly elevated or plane on both sides, usually essentially immersed; flowers axillary, the subtending bracts few, oblong-ovate, up to 8 × 6 mm., fugacious; pedicels 1.5–2 mm. in diameter and 5–27 mm. long at anthesis, sometimes bracteolate near base; perianth-segments 17–19, submembranaceous, essentially eglandular, the outermost 3–7 elliptic or oblong-elliptic, 7–11 × 4–7 mm., the largest ones narrowly oblong or ligulate, 11–17 × 2–4 mm., the innermost few reduced, sometimes only 8 mm. long; stamens 11–20, usually 1- or 2-seriate, 2.3–4 mm. long, the filaments carnose, slightly flattened, broadest at middle, 1.2–2.5 mm. long, the connective faintly emarginate or truncate, the thecae protuberant, 1–1.5 mm.

long; carpels 7–10, most often 8, at anthesis 3.5–5 mm. long, the ovary flattened-ellipsoid, 1.5–2 mm. long, the style erect, subulate, 2–3 mm. long; fruiting specimens not seen.

TYPE LOCALITY: *Illicium religiosum* var. *Masa-Ogatai* was based upon a plant cultivated in Tokyo, originally obtained on Okinawa, Ryu Kyu Islands. According to Makino, the variety was named in honor of Mr. Masasuke Ogata, who apparently sent the material from Okinawa. The original description and figure (photograph of a branchlet) are excellent.

DISTRIBUTION: Northern and central Ryu Kyu Islands. Wilson's specimen bears the rather uninformative altitudinal note of "0–500 m." See map, *fig. 7.*

RYU KYU ISLANDS: AMAMI-OSHIMA: Yuwan-dake, *R. Kanehira 3415* (NY); Nozigawa-Yuwan, *R. Kanehira 3386* (NY). OKINAWA: Kunigami-gun, *R. Kanehira 3278* (NY); Genka Mt., *E. H. Wilson 8110* (A).

LOCAL NAMES and COLOR NOTES: Makino records the Japanese name as *Okinawa-shikimi,* which is apparently an artificial name. The flowers are fragrant and, according to Makino, the perianth-segments are "stramineo-coloured"; Wilson indicates the flowers as white. Anthesis is known to occur from January to March.

SYNONYMY: Makino's use of the binomial in 1927 was in synonymy and therefore invalid, so that a new combination is necessary if this entity is given specific rank. Sasaki, in 1930, listed three Ryu Kyu specimens as representing *I. anisatum;* I assume from their locality that these are referable to the present segregate.

Reasons for the recognition of the Ryu Kyu material as specifically distinct from the Japanese are given in the above discussion of *I. anisatum.* It should be noted that *Kanehira 3386* is somewhat intermediate, its leaf-blades being broader and more obviously nerved than those of typical *I. Masa-Ogatai.* Furthermore, this specimen has the sclereids scantier than the others cited, but its stomata are similarly large.

9. **Illicium** (§ *Badiana*) **philippinense** Merr. in Philip. Jour. Sci. Bot. **4:** 254. 1909, Enum. Phil. Fl. Pl. **2:** 154. 1923.

Illicium sp. Merr. in Philip. Jour. Sci. Bot. **2:** 272. 1907.

Illicium montanum Merr. in Philip. Jour. Sci. Bot. **7:** 81. 1912, Enum. Phil. Fl. Pl. **2:** 154. 1923.

? Illicium arborescens var. *oblongum* Hayata, Ic. Pl. Formos. **2:** 106. 1912; Sasaki, Cat. Gov. Herb. (Taihoku) 215. 1930; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931.

Illicium anisatum var. *leucanthum* Hayata, Gen. Ind. Fl. Formos. 2. 1916.

Illicium leucanthum Hayata, Ic. Pl. Formos. **9:** 2. *fig. 2.* 1920; Nakai in Bot. Mag. Tokyo **36:** 120. 1922; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936; Kanehira, Formosan Trees 187. *fig. 135* (excl. *fig. B?*). 1936.

Illicium daibuense Yamamoto, Suppl. Ic. Pl. Formos. **5:** 22. *fig. 7.* 1932; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936; Kanehira, Formosan Trees 188. *fig. 137.* 1936.

Shrub or tree, up to 8 m. high, the young branchlets brownish, slightly angled or striate-rugulose, 1.5–3 mm. in diameter, the older ones cinereous, subterete, remaining slender; bud-scales papyraceous, oblong, the largest ones up to 5 mm. long; leaves in clusters of 3 or 4 at distal nodes; petioles distally winged, 7–15 mm. long, 1–2 mm. in diameter; leaf-blades coriaceous, when dried dark olivaceous above and pale brown beneath or brownish on both sides, lanceolate or narrowly oblong-elliptic, (4–) 5–10 cm. long, (1.3–) 2–4 cm. broad, attenuate at base, acute to gradually acuminate at apex (actual apex acute to obtuse), slightly recurved at margin, the costa raised above, subprominent beneath, the secondary nerves 5–7 per side, erecto-patent, prominulous or obscure on both surfaces; flowers axillary, often appearing congested toward apices of branchlets, the subtending bracts several, papyraceous, ciliolate, ovate-oblong, up to 5–10 × 5 mm.; pedicels 1–2 mm. in diameter, 5–14 mm. long at anthesis, sometimes

1-bracteolate near middle, the bracteole elliptic-oblong, up to 6 × 5 mm.; perianth-segments 15–21, the outermost 2–6 thin-papyraceous, obscurely glandular and ciliolate, elliptic to obovate-oblong, 7–12 × 4–7 mm., the largest ones (6–14) membranaceous, eciliate, narrowly oblong or ligulate, 11–17 × 2.5–4.5 mm., the innermost few lanceolate to subulate, usually 10–15 × 1.5–3 mm., sometimes smaller; stamens 16–23, usually 2-seriate, 2.5–3.5 mm. long, the filaments carnose, ligulate or subclavate, 1.3–2.5 mm. long, the connective slightly emarginate to obtuse-cuspidate, the thecae protuberant, 1–1.7 mm. long; carpels 8 (rarely 9 or 10), at anthesis 3.5–5 mm. long, the ovary flattened-ellipsoid, 1.5–2 mm. long, the style subulate, nearly straight, 2–3.3 mm. long; fruiting pedicels not thickened but sometimes up to 25 mm. long, the mature carpels 6–8 (rarely 9 or possibly 10) in number, 13–16 mm. long, 5–7 mm. broad, 3–4 mm. thick, gradually narrowed to a subulate acumen 3–4 mm. long; seed stramineous, 6–6.5 × 3.5–4 × 2.5–3 mm. FIG. 6, h.

TYPE LOCALITY: Luzon, Philippine Islands; type, *Curran & Merritt 9515.* The actual type, in the Bureau of Science herbarium, Manila, has presumably been destroyed, but duplicates are cited below.

DISTRIBUTION: Formosa and Philippine Islands, in mountain forest at elevations reported as 1000–2400 m. See maps, *figs. 7* and *9.*

FORMOSA: Mt. Taihei, Prov. Giran, *E. H. Wilson 10182* (A, K, Man, US), *S. Sasaki,* Mar. 1918 (A); Taiheizan, *J. L. Gressitt 419* (A, NY); Taiheisan, between Taiheisan Club and Minamoto, *H. H. Bartlett 6037* (US); Maibarasan, northeast of Horisha, *W. R. Price 750* (K); Mingetsu, Prov. Nanto, *E. H. Wilson 10857* (A); Arisan Range, *W. R. Price 81* (K); Mt. Arisan, *T. Ito 529* (UC).

PHILIPPINE ISLANDS: LUZON: Bontoc Subprov.: *M. Vanoverbergh 1048* (type coll. of *I. montanum,* K), *3353* (Ch); Zambales Prov.: Mt. Tapulao, *H. M. Curran & M. L. Merritt 9515* (TYPE COLL., K, US). MINDORO: Mt. Halcon, *M. L. Merritt 4411* (K).

LOCAL NAMES and COLOR NOTES: Kanehira records the name *Sirobanasikimi* for *I. leucanthum* in Formosa, and Yamamoto records *Hosoba-shikimi* for *I. daibuense.* The flowers are said to be white and to be mature between December and March; the fruits are green to pinkish and have been collected from May to November.

SYNONYMY: Fortunately isotypes of Merrill's two Philippine binomials are available, although the actual types are doubtless destroyed. Examination of perhaps the only surviving isotype of *I. montanum* (at Kew) fails to disclose any characters by which it can be distinguished from *I. philippinense,* with which it agrees in foliage. In the original description the carpels are said to be "about 12," but the four flowers of the isotype which I have examined have either 9 or 10 carpels. Other material of *I. philippinense,* from both the Philippines and Formosa, has uniformly 8 carpels, except *Merritt 4411* (a fruiting specimen with 9 carpels); variation from 8 to 10 is usual in this group of species. It should be noted that *Vanoverbergh 3358,* from the same general locality as the type of *I. montanum,* has only 8 carpels.

Illicium leucanthum is based upon a specimen collected on Arisan, Formosa, by Hayata in 1916. No isotype of this is available to me, but the good original description and flower-drawings indicate that the Formosan entity represented by the above-cited specimens was under consideration. I find no way to distinguish this from Philippine material.

Illicium daibuense is based upon a collection by Matsuda, in 1918, on Daibuzan, Formosa. This specimen was in fruit, and from the excellent original description and drawing I see no reason to differentiate it from Hayata's Formosan species.

Illicium arborescens var. *oblongum* is included in the above synonymy on the authority of Kanehira, who (Formosan Trees 188. 1936) reduced it to *I. daibuense* with the statement that "Yamamoto's type agrees entirely with Hayata's variety." Both types are fruiting specimens and this may well be the proper disposition of the trinomial. Other writers have sometimes submerged it under *I. arborescens,* a species of § *Cymbostemon.*

Although *I. philippinense* is keyed as a close relative of *I. anisatum,* it differs in having oil-cells in the endothecium of the anthers, as discussed above under *I. anisatum.* This fact inclines one to suspect that the true relationship of *I. philippinense* is rather with *I. Tashiroi,* which similarly occurs in Formosa and which, according to Dr. Nast, is the only other entity in § *Badiana* possessing such oil-

cells. The difference in carpel-number, unsatisfactory as it is, appears to be the only useful gross character separating *I. Tashiroi* from *I. philippinense*. However, Prof. Bailey has observed that the foliar sclereids of *I. Tashiroi* are diffuse in the mesophyll, whereas *I. philippinense* has the sclereids lacking or present along the midrib.

10. **Illicium** (§ *Badiana*) **Tashiroi** Maxim. in Bull. Acad. Sci. St. Pétersb. **32:** 479. 1888; Ito & Matsum. in Jour. Coll. Sci. Tokyo **12:** 282. 1900; Matsuda in Bot. Mag. Tokyo **21:** (243). 1907; Matsum. Ind. Pl. Jap. 2 (2): 93. 1912; Nakai in Bot. Mag. Tokyo **36:** 120. 1922; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936.

Illicium anisatum sensu Hayata in Jour. Coll. Sci. Tokyo **25:** 45. 1908, Gen. Ind. Fl. Formosa 2. 1916; non L.

Illicium randaiense Hayata, Ic. Pl. Formos. **9:** 2. *fig. 3.* 1920; Sasaki, Cat. Gov. Herb. (Taihoku) 215. 1930; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931.

Shrub or small tree, the young branchlets brownish or yellowish, slightly angled, 1.5–2 mm. in diameter, the older ones cinereous, subterete, remaining slender; bud-scales papyraceous, elliptic, up to 4 mm. long; leaves in clusters of 3–5 at distal nodes; petioles 8–17 mm. long, 1–2 mm. in diameter; leaf-blades coriaceous or thin-coriaceous, when dried brown or dark olivaceous on both sides, lanceolate-elliptic, 6–11 cm. long and 2–4.2 cm. broad (up to 16.5 × 5 cm. ex Maxim.), attenuate at base, gradually acuminate at apex (actual apex callose-acute or -obtuse), narrowly recurved at margin, the costa slightly raised above or faintly impressed proximally, elevated but not prominent beneath, the secondary nerves 5–8 per side, erecto-patent, slightly raised or obscure on both surfaces; flowers axillary, the subtending bracts few, papyraceous, oblong-ovate, up to 4 × 4 mm., fugacious; pedicels slender (not much exceeding 1 mm. in diameter), 10–20 mm. long at anthesis, apparently ebracteolate; perianth-segments 12–20, the outermost few thin-papyraceous, obscurely glandular, ciliolate, oblong, 7–11 × 5–6 mm., the largest ones membranaceous, eciliate, narrowly oblong, 11–15 × 1.5–4 mm., the innermost 2–4 smaller and often subulate distally, sometimes only 6 × 1 mm.; stamens 17–20, about 2-seriate, 2.7–3.2 mm. long, the filaments carnose, slightly contracted at base, 1.3–2 mm. long, the connective truncate or obtuse, sometimes copiously immersed-glandular, the thecae slightly protuberant, 1–1.3 mm. long; carpels 12 or 13, at anthesis 4–4.7 mm. long, the ovary flattened-ellipsoid, 1.8–2 mm. long, the style erect, subulate 2–2.7 mm. long; fruiting pedicels slender, 12–35 mm. long at maturity, the mature carpels usually 12 or 13 but rarely reduced to 8–10 in number, 15–17 mm. long, 7–8 mm. broad, 3.5–4 mm. thick, narrowed to a short apiculum 2–4 mm. long; seed brown, 7–7.5 × 4.5–5 × 2.5 mm.

TYPE LOCALITY: Maximowicz lists the type and only collection of his species as: "Archipelago *Ya-yama* inter *Liukiu* et *Formosa,* arborea (A. Tashiro flor., 1886)." Further information is given by Ito & Matsumura as follows: "Archipelago Yëma: insula Irumuti in montanis (*Tashiro!* April. 1887, flor.)." The island of Iriomote, not far from the northeastern coast of Formosa, may be accepted as the type locality.

DISTRIBUTION: Southern Ryu Kyu Islands (Yêma Archipelago) and Formosa. For the Kanehira specimen cited below an altitude of 1970 m. is recorded. See map, *fig. 7.*

FORMOSA: Taiheizan, *S. Suzuki,* Aug. 7, 1928 (A); Hassen-zan, *R. Kanehira 21192* (A, UC); South Cape, *A. Henry 1316* (A, K, NY).

LOCAL NAME: Matsumura records the name *Liukiu-shikimi,* which is doubtless artificial. No notes on flower color are available; specimens in both flower and fruit were obtained in August, while the type, a flowering specimen, as noted above was obtained in April.

SYNONYMY: Hayata's reference of Formosan material to *I. anisatum* was later corrected by him to *I. randaiense.* The latter is based upon a specimen collected by Hayata & Mori in 1908 on Randaisan, Formosa. The original description of *I. randaiense* and the accom-

panying sketch of flower and fruit are good, and from them I have no doubt that the Formosan material of § *Badiana* with 12 or 13 carpels was under consideration. Hayata notes that his species differs from *I. Tashiroi* in its free carpels, a generic character. I find no way of separating the two entities.

Two good European-language descriptions of the type of *I. Tashiroi* exist—those of Maximowicz and of Ito & Matsumura. The Formosan specimens cited by me agree very well with these descriptions except that their leaves are considerably smaller than those discussed by Maximowicz. However, if the dimensions given by Ito & Matsumura are correct (and they are taken from a duplicate of the type), our leaves are only a little too small, and those of *Henry 1316* are essentially correct for size.

The similarities between *I. Tashiroi* and *I. philippinense,* as mentioned above, are striking, and additional collections and field-study are desirable before final conclusions can be reached as to the Formosan–Philippine material of § *Badiana.*

11. **Illicium** (§ *Badiana*) **angustisepalum** sp. nov.

Arbor parva (?), ramulis rugulosis gracilibus, hornotinis brunneis leviter angulatis 2–3 mm. diametro, vetustioribus cinereis subteretibus; squamis papyraceis oblongis vel ovatis ad 7 mm. longis; foliis ad nodos distales 4–6 pseudoverticillatis, petiolis superne anguste alatis 10–25 mm. longis 1.5–2 mm. diametro; laminis coriaceis in sicco supra olivaceis vel fusco-viridibus subtus brunneis, oblongo-ellipticis, (5.5–) 7–12 cm. longis, (2–) 2.5–4.2 cm. latis, basi attenuatis, ad apicem calloso-subacutum gradatim acuminatis, margine anguste recurvatis et paullo incrassatis, costa supra leviter elevata subtus prominente, nervis secundariis utrinsecus 6–8 erecto-patentibus utrinque prominulis vel supra subimmersis; floribus axillaribus, bracteis basalibus numerosis papyraceis late ovatis vel oblongis ad 10 × 8 mm. ciliolatis; pedicellis sub anthesi 12–14 mm. longis circiter 1.5 mm. diametro, bracteolis 1 vel 2 ut bracteis sed minoribus; segmentis perianthii 22–24, extimis 4 vel 5 submembranaceis oblongo-obovatis 8–10 × 5–7 mm. leviter ciliolatis, maximis (5 vel 6) membranaceis, anguste oblongis, 14–15 × 3–3.5 mm., intimis 12–14 lineari-filiformibus 12–15 × 0.7–2 mm.; staminibus circiter 24 plerumque 2-seriatis, 2.5–2.8 mm. longis, filamentis carnosis, obovato-ligulatis, 1.2–1.6 mm. longis, antheris oblongis 1.1–1.3 mm. longis, connectivo truncato vel leviter cuspidato; carpellis sub anthesi 11–13, 3.5–4 mm. longis, ovario complanato-ovoideo 1.3–1.7 mm. longo, stylo subulato 2.2–2.5 mm. longo; fructu non viso.

TYPE LOCALITY: Lantao Island, Hongkong; type, *On 2062,* cited below.

DISTRIBUTION: Known only from the type collection. See map, *fig. 7.*

CHINA: HONGKONG: Fung-wong Shan, Lantao Island, *U. On* (Herb. Hongk.) *2062* (A TYPE), Feb. 15, 1905.

The very distinct species described above was in flower on the date of collection. It is readily distinguished from its only close ally, *I. Tashiroi,* by characters pertaining to the number of stamens and perianth-segments and the shape of the latter. From inland continental representatives of § *Badiana* (*I. Simonsii* and its immediate relatives), the new species is distinguished by its longer pedicels and by combinations of various floral characters.

12. **Illicium** (§ *Badiana*) **floridanum** Ellis in Philos. Trans. **60:** 529. *pl. 12.* 1770; L. Mant. 395. 1771; Murr. Syst. Veg. ed. 13. 422. 1774, ed. 14, 507. 1784; Lam. Encycl. Méth. Bot. **1:** 352. 1783; Gaertn. Fruct. et Sem. Pl. **1:** 339. *tab. 69, fig. 6.* 1788; Vitman, Summa Pl. **3:** 336. 1789; [Donovan in] Bot. Review 3. *pl. 2.* 1790; J. F. Gmel. Syst. Nat. **2:** 867. 1791; Schneevoogt, Ic. Pl. Rar. *pl. 9.* 1792; Lam. Rec. Pl. Bot. **2:** *pl. 493, fig. 1, a–h.* 1797; Vent. Tabl. Reg. Vég. **3:** 71. 1799; Curtis in Bot. Mag. **13:** *pl. 439.* 1799; Willd. Sp. Pl. **2:** 1254. 1800; Michx. Fl. Bor.-Am. **1:** 326 (err. typ. 526). 1803; Pers. Syn. Pl. **2:** 93. 1806; Duhamel, Traité Arb. et Arbust. **3:** 190. *pl. 47* (excl. *figs. 1, 2*). 1806; DC. Reg. Veg. Syst. Nat. **1:** 441. 1817; Nutt. Gen. N. Am. Pl. **2:** 18.

1818; Lodd. Bot. Cab. **3:** *pl. 209.* 1818; Mordant de Launay, Herb. Gén. Amat. **3:** *pl. 171.* 1819; Bigelow, Am. Med. Bot. **3:** *76. pl. 48.* 1820; Link, Enum. Pl. **2:** 86. 1822; Lam. Tabl. Encycl. **3:** *37.* 1823; DC. Prodr. **1:** *77.* 1824; Spreng. Syst. Veg. **2:** 643. 1825; Raf. Med. Fl. **2:** 9. *pl. 54.* 1830; Drapiez, Herb. Amat. Fl. **4:** *pl.* [*293*]. 1830; G. Don, Gen. Syst. **1:** 79. 1831; Nees & Sinning, Samml. Schönbl. Gew. 90. [*pl. 39*]. 1831; Piccioli, Antotr. Colt. Fiori 743. *tab. 69.* 1834; de Vriese in Tijdschr. Nat. Gesch. **1:** 43. 1834; Loudon, Arb. et Frut. Brit. **1:** 256. *fig. 32.* 1838; Torr. & Gray, Fl. N. Am. **1:** 42. 1838; Paxton, Mag. Bot. **5:** 147. *pl.* 1838; Spach, Hist. Nat. Veg. **7:** 443. 1839; Dietr. Syn. Pl. **3:** 310. 1843; Cassone, Fl. Med.-Farm. **1:** 104. *tab. 33.* 1847; A. Gray, Gen. Pl. U. S. **1:** 56. *pl. 21.* 1849; Darby, Bot. Southern States **2:** *212.* 1855; Chapman, Fl. Southern U. S. 13. 1860; Baill. Hist. Pl. **1:** 155. 1868–69; Hemsl. in Garden **8:** *270.* 1875; Nichols. Ill. Dict. Gard. **2:** 177. 1885; Morren & de Vos, Ind. Bibl. Hort. Belg. 437. 1887; Prantl in E. & P. Nat. Pfl. III. **2:** 19. 1888; Anon. in Garden **36:** 150. *pl. 714.* 1889; Baill. Dict. Bot. **3:** *pl.* opp. 116 (excl. *figs. b–d*). 1891; A. Gray, Syn. Fl. N. Am. **1:** 59. 1895; Parment. in Bull. Sci. Fr. & Belg. **27:** *222, 295.* 1896; Bailey, Cycl. Am. Hort. **2:** 799. 1900; Small, Fl. Southeastern U. S. 450. 1903; Bean, Trees and Shrubs **1:** 652. 1914; Bailey, Stand. Cycl. Hort. **3:** 1641. 1915; Rehder, Man. Cult. Trees and Shrubs ed. 2, 253. 1940.

Badianifera floridana Kuntze, Rev. Gen. Pl. **1:** 6. 1891.

Shrub or small tree, usually not exceeding 3 m. in height, the branchlets brownish or cinereous, glabrous or very rarely faintly puberulent when young, at first lightly angled or striate-rugulose, 2–4 mm. in diameter, at length subterete; bud-scales papyraceous, oblong, ciliolate, up to 7 mm. long or more; leaves laxly alternate distally on branchlets or 3–6 in distal clusters; petioles 7–20 (–25) mm. long, 1–2 mm. in diameter; leaf-blades thin-coriaceous, when dried green to olivaceous or brown on both surfaces, elliptic-lanceolate or obovate or obovate-oblong, (5–) 7–15 (–20) cm. long, (1.5–) 2–5 (–6) cm. broad, attenuate at base, acuminate at apex (actual apex acute or obtuse, somewhat thickened), often narrowly revolute at margin, the costa slightly impressed or plane above, prominent beneath, the secondary nerves 6–10 per side, spreading, prominulous on both surfaces or nearly plane above, the anastomoses usually obscure; flowers axillary or subterminal, often appearing aggregated below shoot-apex, the subtending bracts several, papyraceous, ovate to oblong, up to 8 × 5 mm., ciliolate, fugacious; pedicels slender (0.6–1 mm. in diameter, slightly thickened distally), (10–) 18–50 (–60, or possibly very rarely to 90) mm. long at anthesis, ebracteolate (or rarely with 1 or 2 scars); perianth-segments 21–33, membranaceous, weakly nerved, the 2 outermost ones obovate or oblong, 7–11 × 3.5–5 mm., rounded at apex, ciliolate, the next 1–3 transitional in size, the largest segments oblong- or linear-obovate, obtuse at apex, 15–27 (–30) × 2–5 mm., the innermost ones often reduced, sometimes subulate, occasionally as small as 5–10 × 1–2 mm.; stamens 30–38 (rarely to 50), 2- or 3-seriate, 2.3–4.7 mm. long, the filaments carnose, 1.3–3 mm. long, narrowed at base, the connective truncate to cuspidate and extending slightly beyond thecae, the thecae protuberant, 1–1.5 mm. long; carpels 11–15 (rarely to 17, very rarely to 20), at anthesis 2.5–4 mm. long, the ovary ellipsoid-triquetrous, 1.5–2 mm. long, the style stout-subulate, 1–2.5 mm. long; fruiting pedicels 1.2–2.5 mm. in diameter, at full maturity 20–75 mm. long, the carpels (10–) 11–15 (very rarely to 20), not always all developed, the mature ones 13–18 mm. long, 7–9 mm. broad, 3–4.5 mm. thick, abruptly cuspidate into a tip 2–3 mm. long; seed pale brown, 6–7 × 4–4.5 × 2–3 mm.

TYPE LOCALITY: The specimen upon which Ellis' description and drawing were based was presumably obtained in a swamp near Pensacola, Florida, by a servant of William Clifton, then Chief Justice of West Florida. Ellis accepts Bartram's mention of the genus as occurring along the St. John River in eastern Florida as referring also to *I. floridanum.* The correct disposition of Bartram's specimen will be noted under *I. parviflorum,* in § *Cymbostemon.*

DISTRIBUTION: Southeastern U. S., from northwestern Florida to eastern Louisiana, at low elevations, often in swamps or in wet places. See map, *fig. 8.*

U. S.: Florida: Gadsden Co.: Quincy and vicinity, *F. Rugel 83* or Apr. 1843 (Ch, M, US), *A. Wood* (NY), *A. W. Chapman* (NY), *J. K. Small et al. 11209* (GH, NY), *E. J. Palmer 35245* (A, M, US); Tologie Creek, *A. W. Chapman* (M, US); Gadsden or Liberty Co.: Between Quincy and Bristol, *C. S. Sargent,* Mar. 15, 1890 (A); Liberty Co.: *W. L. McAtee 3350* (US); Allen Bluff, Apalachicola River, *E. J. Palmer 38548* (A, M, NY); near Watson, *L. Hubricht B2068* (M); between Rock Bluff and Roy, *K. M. Wiegand & W. E. Manning 1222* (GH); Aspalaga, *Cargill,* Apr. 1898 (M); Walton Co.: *A. H. Curtiss 73* (M, NY, UC, US); near De Funiak Springs, *A. H. Curtiss 6378* (GH, M, NY, UC, US); Okaloosa Co.: Near Crestview, *E. J. Palmer 38624* (A, UC); County?: *M. A. Curtis,* in 1841 (M), *A. W. Chapman* (Ch, GH, NY), *C. W. Short,* in 1842 (M), *H. M. Price* (NY). Alabama: Tuscaloosa Co.: Tuscaloosa and vicinity, *R. D. Nevius* (Ch), *W. Johnson* (NY); Warrior River, *R. M. Harper & H. K. Svenson 7449* (GH, UC); Hale Co.: Havana, *L. F. Ward 2025* or Apr. 1892 (A, US); Chilton Co.: Maplesville, *T. G. Harbison 848* (A); Elmore Co.: Deatsville, *C. L. Pollard & W. R. Maxon 300* (A, US); Lee Co.: Auburn, *F. S. Earle 2044* (Ch, M, NY, US); Montgomery Co.: Montgomery, *C. Mohr,* May 18, 1887

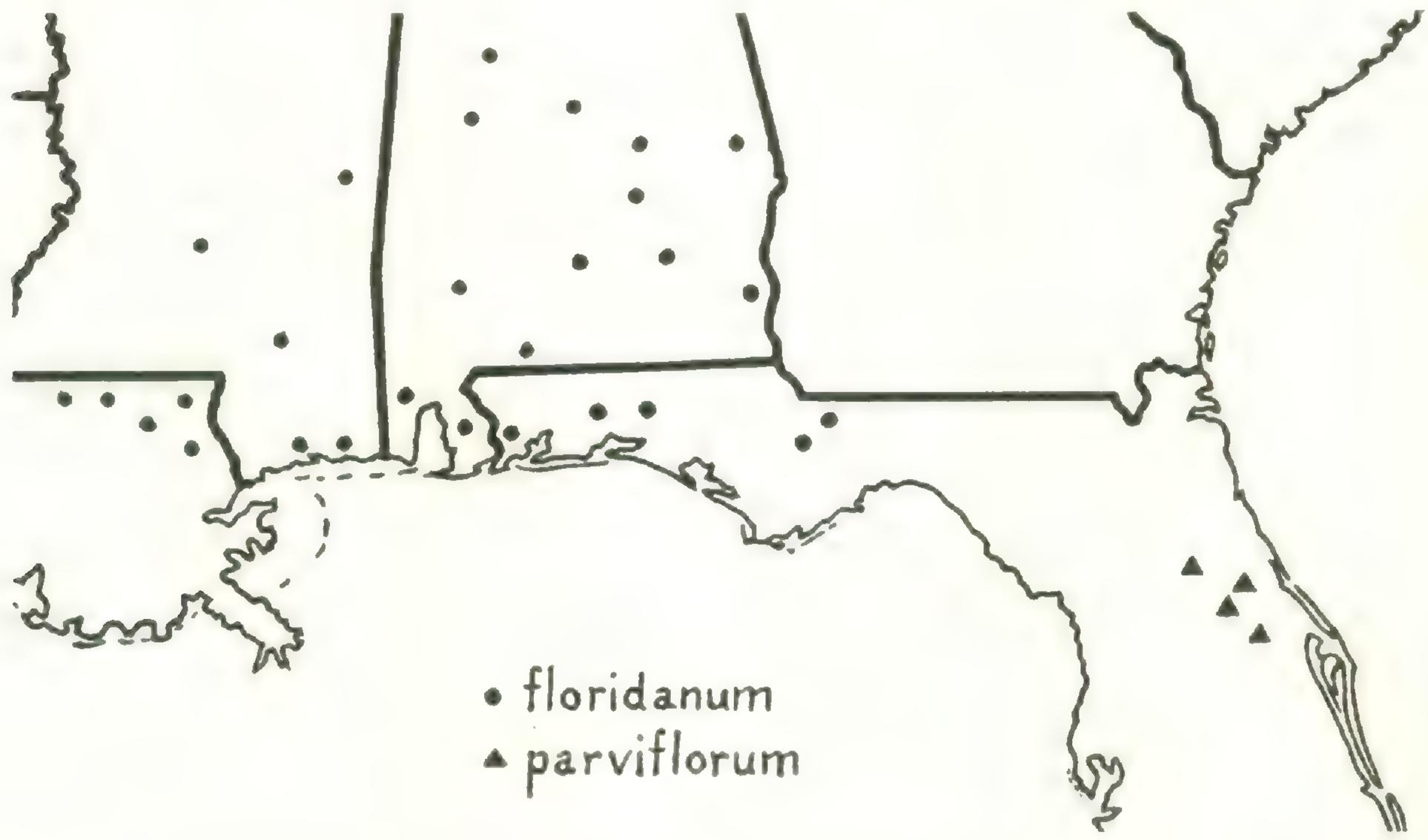

Fig. 8. Approximate known distribution (by counties) of *Illicium floridanum* and *I. parviflorum.* Each symbol represents a county from which herbarium material is available.

(Ch); Pike Co.: Troy, *G. H. Leland,* Mar. 28, 1891 (GH); Butler Co.: Near Greenville, *E. J. Palmer 38690* (A, M, NY, US); Henry Co.: North of Headland, *K. M. Wiegand & W. E. Manning 1223* (GH); Escambia Co.: Atmore, *O. Blanton 42* (A, GH, NY, US); Clarke Co.: Thomasville, *T. G. Harbison 5892* (A); Baldwin Co.: Fairhope, *J. G. Jack 2974* or Mar. 19, 1924 (A, US); Mobile Co.: *J. M. Milligan,* Apr. 1903 (US), *E. W. Graves 627B* (A), *633b* (M); Citronelle, *C. Mohr,* July 5, 1896 (US), *C. F. Baker,* Mar. 17, 1897 (M, NY); Spring Hill, *A. B. Langlois,* Sept., Oct. 1880 (Ch, NY), *C. Mohr,* Mar. 15, 1883 (US), *G. B. Sudsworth,* June 29, 1891 (US), *B. F. Bush 341* (A, M, NY), *K. K. Mackenzie 3996* (M, NY), *L. M. Dougan,* Dec. 30, 1913 (M), *J. A. Drushel,* Dec. 30, 1913 (M), *T. G. Harbison 5876* (A), *W. C. Coker,* Dec. 27, 1937 (NY); Mobile and vicinity, Herb. C. W. Short (coll. *Drake*) (GH), *C. Mohr,* Mar., Apr. [year?] (Ch), Apr. 1868 (US), May 10, 1875 (US), Mar. 1878 (Ch), Mar. 20, 1890 (A), Apr. 9, 1892 (US), Mar. 30, 1895 (US), *C. E. Faxon,* Mar. 1883 (A, GH), *C. F. Baker 1215* or Apr. 25, 1898 (Ch, GH, UC); County?: *S. B. Buckley,* Aug. 1841 (GH, M). Mississippi: Lauderdale Co.: *E. Hilgard,* May, 1859 (M); Meridian and vicinity, *W. M. Canby 8* (GH, US), *C. S. Sargent,* Apr. 12, 1900 (A), *T. G. Harbison,* Apr. 27, 1915 (A); Simpson Co.: Harrisville, *S. B. Muller,* July 26, 1892 (A, US); near Saratoga, *E. T.*

Wherry, Sept. 5, 1936 (A); Forrest Co.: Hattiesburg, *T. G. Harbison 6091* (A); Jackson Co.: Ocean Springs, *F. S. Earle,* Feb. 17, 1888 (NY), *A. B. Seymour 32* (GH, M), *C. L. Pollard 1162* (GH, M, US), *J. Skehan,* Apr. 9, 1895 (A, M, US), Sept. 14, 1895 (A), *S. M. Tracy 5150* in part, Feb. 25, 1898 (GH, M, NY, US), *5150* in part, Apr. 25, 1900 (GH, M, UC); Harrison Co.: Pass Christian, *A. J. Heading,* Mar. 1889 (GH), *J. Dehoff,* Apr. 8, 1889 (UC, US); Biloxi and vicinity, *C. F. Baker,* July 23, 1897 (M, NY), *C. S. Sargent,* Apr. 1, 1917 (A); County?: *E. Hilgard,* in 1858 (M). LOUISIANA: Washington Co.: Northeast of Pine, *D. S. & H. B. Correll 9230* (GH, NY); Washington or St. Tammany Co.: Pearl River, *J. F. Joor,* Apr. 16, 1887 (Ch); St. Tammany Co.: Covington and vicinity, *J. Hale* (M), *A. B. Langlois,* Apr. 16, 1894 (Ch, M, US), *W. M. Canby 9* (GH, US), *Bro. Anect 13* (US), *G. Arsène 11944* (US); Sulphur Spring, *G. Arsène 11603* (US), *11634* (US); Bogue Falia River, *A. B. Langlois,* Aug. 1885 (US), *J. H. Mellichamp,* Aug. 1898 (A, GH, M), *C. S. Sargent,* Apr. 1, 1900 (A, M, US); Tangipahoa Co.: Robert, *E. T. Wherry,* Sept. 11, 1936 (A); Hammond and vicinity, *L. Gallup,* Mar. 15, 1889 (US), *C. S. Sargent,* Mar. 29, 1917 (A); St. Helena Co.: Montpelier, *C. A. Brown 5214* (A); East Feliciana Co.: Amite River, *W. R. Dodson,* Aug. 5, 1894 (M); "Feliciana," *Carpenter* (GH); County?: *T. Drummond,* in 1832 or 1833 (GH, NY) ("New Orleans").

CULTIVATED: Hort. Cantab., in 1845 (GH); *M. G. Henry,* Nov. 1, 1939 (A) (Gladwyne, Pa.); *A. Schott,* Feb. 21, 1860 (Public Gardens, Washington, D. C.); *G. Vasey,* in 1875 (US) (greenhouse, Washington, D. C.); Herb. A. Rehder *3059* (A) (Isola bella, ex herb. A. Usteri); Hort. Desprez, Apr. 19, 1826 (NY).

LOCAL NAMES and COLOR NOTES: The local names *Florida anise-seed tree* and *Red-flowered anise-seed tree* are recorded, but doubtless many variants are used locally. The perianth-segments are deep red to purple, causing this to be one of the most striking species of the genus. The plant is more or less evergreen, specimens with flower-buds having been collected from December to February; it bears mature flowers from March to May and mature fruits from late June to October.

This very distinct American species has not been confused, in the literature, with anything else; it is a rare satisfaction to find a species of *Illicium* upon the identity of which all authors agree. The species is clearly separable from all Old World members of § *Badiana* on the basis of its comparatively long pedicels, numerous stamens, and brightly colored perianth-segments. Its only close relative is the following new species.

13. **Illicium** (§ *Badiana*) **mexicanum** sp. nov.

Frutex vel arbor parva (?), ramulis rugulosis, hornotinis brunneis leviter angulatis vel subteretibus 2–3.5 mm. diametro, vetustioribus cinerascentibus ad 5 mm. diametro; foliis ad nodos distales 3–6 subaggregatis, petiolis 10–30 mm. longis 1–2 mm. diametro; laminis subcoriaceis in sicco utrinque fuscis, elliptico-lanceolatis, 8–16 cm. longis, 2–4.3 cm. latis, basi attenuatis, apice gradatim acuminatis (apice ipso calloso-apiculato), margine anguste recurvatis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 6–9 erecto-patentibus utrinque prominulis vel supra subplanis; floribus axillaribus, bracteis basalibus paucis papyraceis oblongo-lanceolatis ad 12 × 5 mm.; pedicellis longissimis sub anthesi 80–105 mm. longis 1.2–2 mm. diametro superne leviter incrassatis ebracteolatis; segmentis perianthii 24–33 membranaceis obscure pellucido-glandulosis eciliatis vel obscure ciliolatis apice acutis, extimis 3–6 (maximis) ligulatis 15–20 × 4–6 mm., interioribus gradatim angustioribus, intimis (circiter 16) lanceolatis vel e basi ovato subulatis 12–17 × 1–3 mm.; staminibus 25–37, 2- vel 3-seriatis, 3.2–4.2 mm. longis, filamentis ligulatis copiose pellucido-glandulosis 1.8–2.5 mm. longis, antheris oblongo-ellipsoideis 1.4–2 mm. longis, connectivo copiose immerso-glanduloso mucronato quam thecis longiore; carpellis sub anthesi 19–21 patentibus 3.8–4.2 mm. longis, ovario complanato-deltoideo 2–2.5 mm. longo 2–3 mm. lato, stylo conico-subulato 1.3–2 mm. longo recurvato; pedicellis sub fructu paullo incrassatis, carpellis saepe ad 13 reductis patentibus, immaturis 14–16 mm. longis, cir-

citer 7 mm. latis, 2–3 mm. crassis, in acuminem 1–2 mm. longum fragilem abrupte cuspidatis.

TYPE LOCALITY: Vera Cruz, Mexico; type, *Purpus 6137,* cited below.

DISTRIBUTION: Known only from the type collection, for which no altitude was recorded. See map, *fig. 4.*

MEXICO: VERA CRUZ: Sierra Madre between Misantla and Naolinca, *C. A. Purpus 6137* (GH, M, NY, UC 150133 TYPE, US), Aug. 1912 (in damp forests).

LOCAL NAME: *Mata caballo* is a name recorded by Purpus. The specimen bore both flowers and immature fruits on the date above, but no flower-color was stated. Because of the similarity between this species and *I. floridanum,* and because of the appearance of the dried flowers, it may be assumed that the perianth-segments were red, as in the preceding species.

The remarkable collection described above seems to the writer amply distinct from *I. floridanum;* it is the only Mexican collection of the genus which appears to have been reported and therefore indicates a notable extension of the range of *Illicium.* The University of California sheet, which is the best of those available, was originally annotated by Brandegee as a new species with an epithet drawn from the native name *mata caballo,* and a brief diagnosis in Brandegee's hand is attached to the sheet. However, Brandegee later changed his mind and covered his original label with one bearing the identification *Illicium floridanum,* as which duplicates were distributed. It seems best to avoid the proposed Greek specific epithet in favor of the simpler geographical one here adopted.

Although obviously related to *I. floridanum,* the Mexican plant is quite extraordinary in the length of its pedicels and the extreme number of its carpels; differences in the shape of perianth-segments and carpels are also apparent, as mentioned in my key to species. Although *I. floridanum* is reasonably consistent in pedicel-length, with pedicels only rarely exceeding 50 mm. in length at anthesis, it should be mentioned that a single specimen (*Mellichamp,* Aug. 1898 [GH]) has a flower with a pedicel 90 mm. long. As this same specimen bears fruits with pedicels of average length (about 40 mm.), it may be questioned whether the single flower is normal. Similarly, the number of carpels in *I. floridanum* at anthesis is usually not more than 15, rarely 17; but mention should be made of a single collection (*Blanton 42*) in which the fruiting carpels are 14–20 in number. The existence of a few unusual or perhaps abnormal specimens in *I. floridanum* does not seriously weaken the status of *I. mexicanum,* in view of the noteworthy geographical isolation of the latter entity.

The flowers of this species often appear to arise in twos or threes from subapical leaf-axils. Frequently one flower is fully mature while others of the same cluster are juvenile. In the young state the flowers are not conspicuous for length of pedicel, and the perianth-parts appear small. Apparently both pedicel and perianth enlarge rapidly toward anthesis. All dimensions of floral parts given in the description are taken from mature flowers. Although the outer perianth-segments in the young flowers suggest that they will remain small, this seems not to be the case. In mature flowers the outer segments are about as large as any. In three flowers dissected the carpels were 19–21, but in the available fruits (several) the carpels are always 13, indicating that many carpels are abortive. The fruits are not yet mature and dimensions are unreliable.

14. **Illicium** (§ *Cymbostemon*) **parviflorum** Michx. ex Vent. Tabl. Reg. Vég. **3:** 71. 1799; Vent. Descr. Pl. Nouv. Jard. Cels *22. pl. 22.* 1801; Michx. Fl. Bor.-Am. **1:** 326 (err. typ. 526). 1803; Jaume St.-Hil. Exp. Fam. Nat. **2:** 75. 1805; Duhamel, Traité Arb. et Arbust. **3:** 190. 1806; Pers. Syn. Pl. **2:** 93. 1806; DC. Reg. Veg. Syst. Nat. **1:** 442.

1817; Nutt. Gen. N. Am. Pl. **2**: 18, 1818; Elliott, Bot. S. Car. & Georgia **2**: 35. 1821; Mordant de Launay, Herb. Gén. Amat. **5**: *pl. 330*. 1821; Link, Enum. Pl. **2**: 86. 1822; DC. Prodr. **1**: 77. 1824; Spreng. Syst. Veg. **2**: 644. 1825; Drapiez, Herb. Amat. Fl. **4**: *pl.* [*294*]. 1830; Raf. Med. Fl. **2**: 10. 1830; G. Don, Gen. Syst. **1**: 79. 1831; de Vriese in Tijdschr. Nat. Gesch. **1**: 42. *pl. 2, f. I–XXIX*. 1834; Loudon, Arb. et Frut. Brit. **1**: 259. 1838; Torr. & Gray, Fl. N. Am. **1**: 42. 1838; Raf. Autikon Bot. 86. 1840; Dietr. Syn. Pl. **3**: 310. 1843; Darby, Bot. Southern States **2**: 211. 1855; Chapman, Fl. Southern U. S. 13. 1860; Baill. in Adansonia **7**: 361. 1867, Hist. Pl. **1**: 151. *f. 191–194*. 1868–69; Nichols. Ill. Dict. Gard. **2**: 177. 1885; Morren & de Vos, Ind. Bibl. Hort. Belg. 437. 1887; A. Gray, Syn. Fl. N. Am. **1**: 59. 1895; Parment. in Bull. Sci. Fr. & Belg. **27**: 221, 294. 1896; Bailey, Cycl. Am. Hort. **2**: 799. 1900; Small, Fl. Southeastern U. S. 450. 1903; Bailey, Stand. Cycl. Hort. **3**: 1641. 1915.

Illicium anisatum sensu Bartram, Journal 49. 1766; non L.

Cymbostemon parviflorus Spach, Hist. Nat. Veg. **7**: 446. 1839.

Badianifera parviflora Kuntze, Rev. Gen. Pl. **1**: 6. 1891.

Large spreading shrub up to 7 m. high (in cultivation often a small tree up to 13 m. high), the branchlets brown to grayish, subterete, often striate-rugulose when dried, slender, 2–4 mm. in diameter distally; leaves irregularly alternate or pseudoverticillate in threes or fours at the distal nodes; petioles slender (1–1.5 mm. in diameter), 8–16 mm. long (up to 25 mm. long in cultivated specimens); leaf-blades papyraceous to thin-coriaceous, dull green to olivaceous or brownish when dried, narrowly elliptic to obovate-elliptic, 6–12 cm. long, (2–) 2.3–5 cm. broad (in cultivated specimens up to 14.5 × 6 cm.), acute at base, rounded or broadly obtuse or faintly emarginate at apex, narrowly revolute at margin, the costa nearly plane above and prominent beneath, the secondary nerves usually 4–7 per side, erecto-patent, slightly elevated or subimmersed on both sides, obscurely anastomosing; flowers axillary or subterminal, solitary or 2 or 3 together on minute glomerules, the subtending bracts several, papyraceous, ovate-deltoid, ciliolate, rounded, 1–2 mm. long and broad; pedicels slender, 0.4–1 mm. in diameter, (7–) 12–23 mm. long at anthesis, with 2–5 scattered bracteoles, these similar to subtending bracts, 1–1.5 mm. long; perianth-segments 12–15, papyraceous to subcoriaceous, pellucid-glandular-punctate, rounded at apex, the outer ones ciliolate, the outermost ones broadly deltoid, 1–1.5 × 1.5–3 mm., the inner ones (largest) orbicular- or oblong-obovate, eciliate, 5.5–7 × 4.5–5.5 mm., the innermost 1 or 2 sometimes reduced and transitional toward stamens; stamens uniseriate, 6 or 7, carnose, obovoid, narrowed at base, obtuse at apex, 2.5–3.5 mm. long, the filaments immersed-glandular, the thecae introrse, 0.5–1 mm. long, immersed in the connective-tissue; carpels 11–13 at anthesis, 1.7–2.5 mm. long, the ovary flattened-ellipsoid, the style erect, 0.4–0.7 mm. long; fruiting pedicels only slightly enlarged, the carpels 10–13 at maturity, 10–15 mm. long, 5–6 mm. broad, 2–5 mm. thick, gradually attenuate into a short acumen; seed brown, at maturity 5–6 mm. long, 4–5 mm. broad, 2–3 mm. thick.

TYPE LOCALITY: Ventenat's descriptions were based on a plant ". . . introduit chez Cels en 1789." In the original publication he states also that the species flowered in the collection of Le Monnier, at Montreuil. Francis Harper (in Trans. Am. Philos. Soc. **33**: 74. 1942) is not strictly correct, therefore, in implying that the type locality of the species is in the Lake George region, where Michaux observed it. It is quite probable, to be sure, that Ventenat had his cultivated plant from Michaux, and to this extent the Florida locality may have been the ultimate source. Michaux observed the plant first on May 5, 1788, on the shores of Lake George (see the printing of Michaux's Journal in Proc. Am. Philos. Soc. **26** (129): 36. 1889). The first discussion of the plant was apparently that of John Bartram in 1766 (cited above under *I. anisatum*), in connection with which Harper's notes are very informative. Harper states that there are still acres of *I. parviflorum* between Yellow Bluff and Lisk Point on Lake George. He believes that Michaux's locality was at Salt Springs, in the present Marion County.

DISTRIBUTION: Eastern Florida, along the upper St. John River, perhaps limited to the region from Lake George southward. See map, *fig. 8*.

Although several authors have listed this species as occurring in "southern Georgia," I have seen no positive herbarium evidence of an indigenous occurrence in that State. The specimen cited below from "Georgia," collected by Frazer in 1808, is not sufficiently documented to offer as proof of the native occurrence of *I. parviflorum* outside of the limited region mentioned above.

The species apparently grows sparingly (or at least very locally) in low places along streams. Its rarity is indicated by the number of indigenous specimens in herbaria. Several writers have mentioned that it is common in gardens in the southeastern States or even "almost naturalized."

U. S.: "GEORGIA": *Frazer,* in 1808 (NY). FLORIDA: Volusia Co.: Hawkinsville, *S. C. Hood,* June 27, 1910 (M); Volusia or Seminole Co.: Lake Monroe, *H. O'Neill,* July 31, 1929 (US); Seminole Co.: Little Wekiva River, s. w. of Old Glen Ethel Station, *C. H. Baker 500a* (A), *500c* (A), *500y* (US), *500z* (A); Lake Co.: "Deep Hammock," *S. C. Hood,* May 7 and Sept. 21, 1910 (GH); County?: Herb. Chapman, "ex Durand" (NY).

CULTIVATED: *J. H. Mellichamp,* Dec. 1897 (US) (Turnbull Plantation on Cooper River [Berkeley Co.?], S. Car.), Dec. 10, 1897 or Dec. 10, 1898, or without date (A, M) (Chicora Park, Charleston, S. Car.), in 1891 (A) (near Hilton Head, Beaufort Co., S. Car.), in 1882 (US) (Bluffton, Beaufort Co., S. Car.); *L. R. Gibbes,* June 3, 1859 (NY) ("Dr. Holbrooke's Farm," S. Car.); *C. H. Baker 501a* (A) (Orlando, Orange Co., Fla.), *501b* (US) (Orlando, Fla.), *502* (A) (Orlando, Fla.; sidewalk tree), *541* (A) and Oct. 25, 1918 (A) (Sydonie Estate, Zellwood, Orange Co., Fla.); *C. Mohr,* June, 1879, and June, 1880 (Ch, US) (Langdon's Nursery, Mobile, Ala.); *G. Vasey,* in 1879 (US) ("greenhouse"); *C. T. White 2460* (A) (Botanic Gardens, Brisbane, Australia).

LOCAL NAMES and COLOR NOTES: *Small-flowered anise-seed tree* is the name most commonly recorded for this species, but F. Harper (see reference above under type locality) states that *white sassafras* is commonly used around Lake George. The flowers, with yellow perianth-segments, are in anthesis during May and June, and fruits have been collected from July to September.

All the American material of § *Cymbostemon* has commonly been passing in herbaria and literature as *I. parviflorum,* but I cannot agree that the specimens from Cuba and Haiti belong with the Florida plant. The three species which I recognize are, of course, closely related, perhaps more closely than indicated by my key to species; they are characterized by their small flowers and reduced number of stamens, which are much-thickened, contracted distally, and with semi-immersed thecae. The following short key may be taken to supplement the larger key.

SUPPLEMENTARY KEY TO THE AMERICAN SPECIES OF § CYMBOSTEMON

Apex of leaf-blades rounded or broadly obtuse, sometimes obscurely mucronate, sometimes faintly emarginate; perianth-segments 12–16, the largest ones 4.5–7 mm. long; stamens 4–7, 2.5–3.5 mm. long.
- Stamens 6 or 7; carpels (10–) 11–13; eastern Florida .....14. *I. parviflorum.*
- Stamens 4 or 5; carpels uniformly 8 in all specimens seen; leaf-blades comparatively small and often revolute-margined; Oriente, Cuba .....28. *I. cubense.*

Apex of leaf-blades acute or, if obtuse, callose-mucronulate; perianth-segments about 20, the largest ones not exceeding 4 mm. in length; stamens 8 (apparently uniformly so, but few specimens available), not exceeding 2 mm. in length; carpels 10–13 (rarely reduced to 8 in fruit); Haiti .....15. *I. Ekmanii.*

15. **Illicium** (§ *Cymbostemon*) **Ekmanii** sp. nov.

Illicium parviflorum sensu Barker & Dardeau, Fl. Haïti 118. 1930; non Michx. ex Vent.

Arbor parva (?), ramulis gracilibus brunneis vel cinereis subteretibus vel obscure angulatis apicem versus 1.5–2 mm. diametro; foliis disperse alternatis vel nodis subaggregatis, petiolis gracilibus (0.7–1.5 mm. diametro) 4–15 mm. longis basi paullo incrassatis; laminis in sicco chartaceis vel coriaceis utrinque brunnescentibus, anguste ellipticis vel elliptico-obovatis, (3–) 6–9 cm. longis, (1–) 2–3.6

cm. latis, basi acutis vel attenuatis, apice obtusis vel acutis et calloso-mucronulatis, margine anguste revolutis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 5–8 patentibus utrinque subprominulis vel immersis obscure anastomosantibus; floribus axillaribus vel subterminalibus solitariis vel ut videtur binis, bracteis basalibus minutis caducis; pedicellis sub anthesi 9–13 mm. longis basi 0.8–1.5 mm. diametro superne paullo incrassatis, bracteolis 1 vel 2 papyraceis suborbicularibus ciliolatis circiter 1 × 1.2 mm.; segmentis perianthii circiter 20 glabris (exterioribus interdum obscure puberulis) pellucido-glandulosis, exterioribus papyraceis ciliolatis, interioribus tenuiter carnosis eciliatis, extimis 5 minutis ovato-deltoideis obtusis 1–1.5 × 1.5–3 mm., maximis oblongo-suborbicularibus 3–4 × 3–3.5 mm., intimis obovatis reductis; staminibus uniseriatis 8 (semper?) 1.8–2 mm. longis, filamentis complanato-ellipsoideis vel -obovoideis obscure pellucido-glandulosis basi contractis, thecis semi-immersis 0.8–0.9 mm. longis introrsis; carpellis sub anthesi plerumque 13 et 1.7–1.8 mm. longis, ovario in stylum crassum obtusum 0.5–0.8 mm. longum gradatim angustato; pedicellis sub fructu ad 18 mm. longis, carpellis maturitate 10–13 (raro 8), 8–14 mm. longis, 4–5 mm. latis, 3–4 mm. crassis, apice breviter acuminatis; semine pallido-brunneo maturitate circiter 5.2 × 3.7 × 2 mm.

TYPE LOCALITY: Massif du Nord, Haiti; type, *Ekman H.8209,* cited below.

DISTRIBUTION: Haiti, in mountains; recorded from altitudes of 900–1100 m. See map, *fig. 4.*

HAITI: Massif du Nord, Marmelade, M. Belle-Terre, *E. L. Ekman H.8209* (US 1,412,978 TYPE), May 22, 1927; Massif de la Selle, Port-au-Prince, M. de l'Hôpital, *E. L. Ekman H.2230* (US); Massif de la Hotte, western group, Pestel, Morne Delcour, *E. L. Ekman H.9002* (US); Montagnes de la Hotte, Delcour village, *W. J. Eyerdam 361* (GH, NY, US).

COLOR NOTES: Only the type specimen is in flower and this has no color notes, but from the appearance of the perianth one may assume that it is yellow, as in *I. parviflorum.* The other cited specimens, in fruit, were obtained in August and October.

SYNONYMY: In referring the Haitian plant to *I. parviflorum,* Barker & Dardeau did not cite a specimen, but their locality was "Massif du Nord près de Marmelade," indicating that possibly the Ekman collection was seen by them.

As indicated above under *I. parviflorum,* this Haitian plant is clearly distinct from the Florida species on the basis of its acute leaf-blades and its more numerous and smaller perianth-segments and stamens.

16. **Illicium** (§ *Cymbostemon*) **lanceolatum** sp. nov.

? Illicium Griffithii sensu Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 30. 1905 [repr. Contr. Fl. As. Or. **2**: 30. 1907]; non Hook. f. & Thoms.

Illicium Henryi sensu Rehder & Wilson in Jour. Arnold Arb. **8**: 110. 1927; Hand.-Maz. Symb. Sin. **7**: 245. 1931; Cheng in Contr. Biol. Lab. Sci. Soc. China **9**: 285. 1934; non Diels.

Frutex vel arbor 3–10 m. alta, ramulis gracilibus hornotinis brunneis vel purpurascentibus teretibus vel leviter angulatis 2–3 mm. diametro, vetustioribus saepe cinereis rugulosis 4–6 mm. diametro; foliis alternatis vel nodis distalibus laxe aggregatis, petiolis gracilibus 1–2.5 mm. diametro (5–) 7–15 mm. longis; laminis coriaceis in sicco plerumque supra fusco-viridibus vel olivaceis subtus brunnescentibus, lanceolatis vel obovato-lanceolatis, (6–) 7–15 cm. longis, 1.5–4.5 cm. latis, basi attenuatis, superne gradatim angustatis vel acuminatis (apice ipso obtuso vel calloso-acuto), margine anguste revolutis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 6–10 brevibus erecto-patentibus utrinque immersis vel inconspicue elevatis obscure anastomosantibus; floribus axillaribus vel subterminalibus solitariis vel ut videtur binis, bracteis basalibus paucis minutis mox caducis; pedicellis gracilibus (0.8–2 mm. diametro) subrugulosis sub anthesi 15–50 mm. longis ebracteolatis vel cicatricibus bracteolarum 1 vel 2 ornatis; segmentis perianthii 10–15 obscure pellucido-punctatis, exterioribus papyraceis cili-

olatis, interioribus crassioribus carnosis eciliatis, extimis deltoideo-ovatis obtusis 3.5–7 × 3–6 mm., maximis ellipticis vel oblongo-obovatis 7–12.5 × 5–8 mm., intimis 5–9 × 2–5 mm.; staminibus uniseriatis 6–11 oblongis 2.8–3.9 mm. longis, filamentis tenuiter carnosis ligulatis interdum obscure punctatis 1.5–2.5 mm. longis, antheris distinctis 1–1.5 mm. longis, connectivo inconspicuo truncato vel leviter emarginato, thecis protuberantibus; carpellis sub anthesi 10–13, 3.9–5.3 mm. longis, ovario complanato-ellipsoideo 1.5–2 mm. longo in stylum erectum subulatum gracilem 2–3.3 mm. longum subito angustato; pedicellis sub fructu ad 55 (raro ad 80) mm. longis gracilibus, carpellis maturis 10–13 (raro 9), 14–21 mm. longis, 5–9 mm. latis, 3–5 mm. crassis, in acuminem conspicuum 3–7 mm. longum attenuatis; semine pallide cinereo-brunneo maturitate 7–7.5 × 5 × 2.5–3.5 mm. Fig. 11, a–g.

Type locality: Chekiang; *Chen 3171,* cited below, is selected as the type because it is by far the best flowering specimen available, although it is not accompanied by precise locality data.

Distribution: Eastern China, from southern Kiangsu and Anhwei to Kiangsi and Fukien; altitudes of 300–1200 m. have been recorded, and the plant is mentioned from a variety of habitats, such as mixed forest, open woods, or brushy slopes, often in ravines or along streams. See map, *fig. 10.*

CHINA: Kiangsu: "Hai Wei," s. of I-hsing, on border of Chekiang, *R. C. Ching & C. L. Tso 530* (A). Anhwei: T'ien-chu Shan, Chien-shan Hsien, *C. S. Fan & Y. Y. Li 245* (A); Wan-shan, *W. C. Cheng 3898* (US); without locality, *R. C. Ching 2519* (A, K, UC). Chekiang: Ningpo [Yin Hsien] Mts., *E. Faber 1718* (Herb. Hongk. *87*) (K); T'ien-mu Shan, *T. Tang & W. Y. Hsia 126* (A), *R. C. Ching 5060* (A); T'ien-t'ai Shan, *Y. L. Keng 1011* (A, UC); "Chin Chin Ping, n. of Siachu" [Hsien-chü?], *R. C. Ching 1641* (A, GH, K, UC, US); between P'ing-yang and T'ai-shun, *R. C. Ching 2123* (A, UC, US); without locality, *S. Chen 662* (A), *3171* (A type), May 17, 1934, *3496* (A), *4378* (A), *R. C. Ching 4858* (A), *Y. Y. Ho 1475* (A). Kiangsi: Ta-hui-hsiang, Ku-ling, Lu Shan, *N. K. Ip 1804* (K, M, Man, UC); Lu Shan, *A. N. Steward 2712* (A, K, M), *4637* (UC, US), *H. H. Chung & S. C. Sun 478* (A, NY), *582* (A, NY); near "Lipeichiao," Ts'un-ch'ien, *Y. Tsiang 10196* (NY); Mt. "Hangaodsu," between Ning-tu and "Tjingan," *T. H. Wang* (in *Handel-Mazzetti*) *495* (A). Fukien: Near the Chekiang border, *R. C. Ching 2256* (A, K, UC, US); Yen-p'ing Gorge, *S. T. Dunn 806* (Herb. Hongk. *2440*) (A); Ku Shan, *H. H. Chung 7609* (A, NY).

Color notes: The perianth-segments are said to be purplish red, although the outermost ones may be greenish; mature flowers have been obtained from April to June. Mature fruits are found from the end of June to September. I find no records of local names applied to this entity.

Synonymy: The specimen upon which Finet & Gagnepain based their report of *I. Griffithii* was collected by Latouche in Fukien; although I have not seen this, *I. lanceolatum* is the only species of the genus thus far known from that province.

The references to *I. Henryi* cited above are based upon collections which for the most part are available to me, such as *Ching 2519, Cheng 3898,* and *Wang 495.*

Although *I. lanceolatum,* because of its reduced number of stamens, is keyed in the group of § *Cymbostemon* with *I. parviflorum* and *I. Ekmanii,* it is actually only remotely related to these American species. The real relationship of *I. lanceolatum* is doubtless with *I. majus* and *I. Henryi,* the three species forming a group which is discussed at greater length under *I. majus,* below.

17. **Illicium** (§ *Cymbostemon*) **parvifolium** Merr. in Jour. Arnold Arb. **19**: 27. 1938.

Small tree or shrub, about 3 m. high, the young branchlets brownish, subterete, 1.5–2 mm. in diameter, becoming gray and up to 4 mm. in diameter; leaves pseudoverticillate in clusters of 3–6 at distal nodes; petioles 5–13 mm. long, 1–1.5 mm. in diameter; leaf-blades coriaceous, when dried dark green above and brown beneath, oblong-elliptic, (3–) 4–6.5 cm. long, (1.3–) 1.8–2.5 cm. broad, obtuse at base and suddenly decurrent on the petiole, obtuse to rounded at apex, narrowly recurved at margin, the costa nearly plane or faintly impressed above, raised be-

neath, the secondary nerves 4–6 per side, subspreading, faintly prominulous or subimmersed on both sides, obscurely anastomosing; flowers subterminal subtended by a few papyraceous deltoid-ovate subacute bracts about 2 mm. long and broad, these soon caducous; pedicels 10–17 mm. long at anthesis and 1–2 mm. in diameter, ebracteolate or with a single fugacious bracteole near middle; perianth-segments about 13, the outer ones papyraceous and sparsely ciliolate, the inner ones carnose and eciliate, the outermost few oblong-suborbicular, 5–7 × 5–6 mm., the largest ones elliptic to suborbicular, 7–10 × 5.5–8 mm., the innermost 2 or 3 reduced to 6–7 × 3–5 mm.; stamens 13–15, 1- or 2-seriate, carnose, oblong, 3–3.8 mm. long, the filaments ligulate, 1–2 mm. broad, slightly narrowed at base, the connective thickened, truncate or faintly emarginate at apex, the thecae semi-immersed, 1.5–1.8 mm. long; carpels 10–13 at anthesis, 4.5–5.5 mm. long, subu-

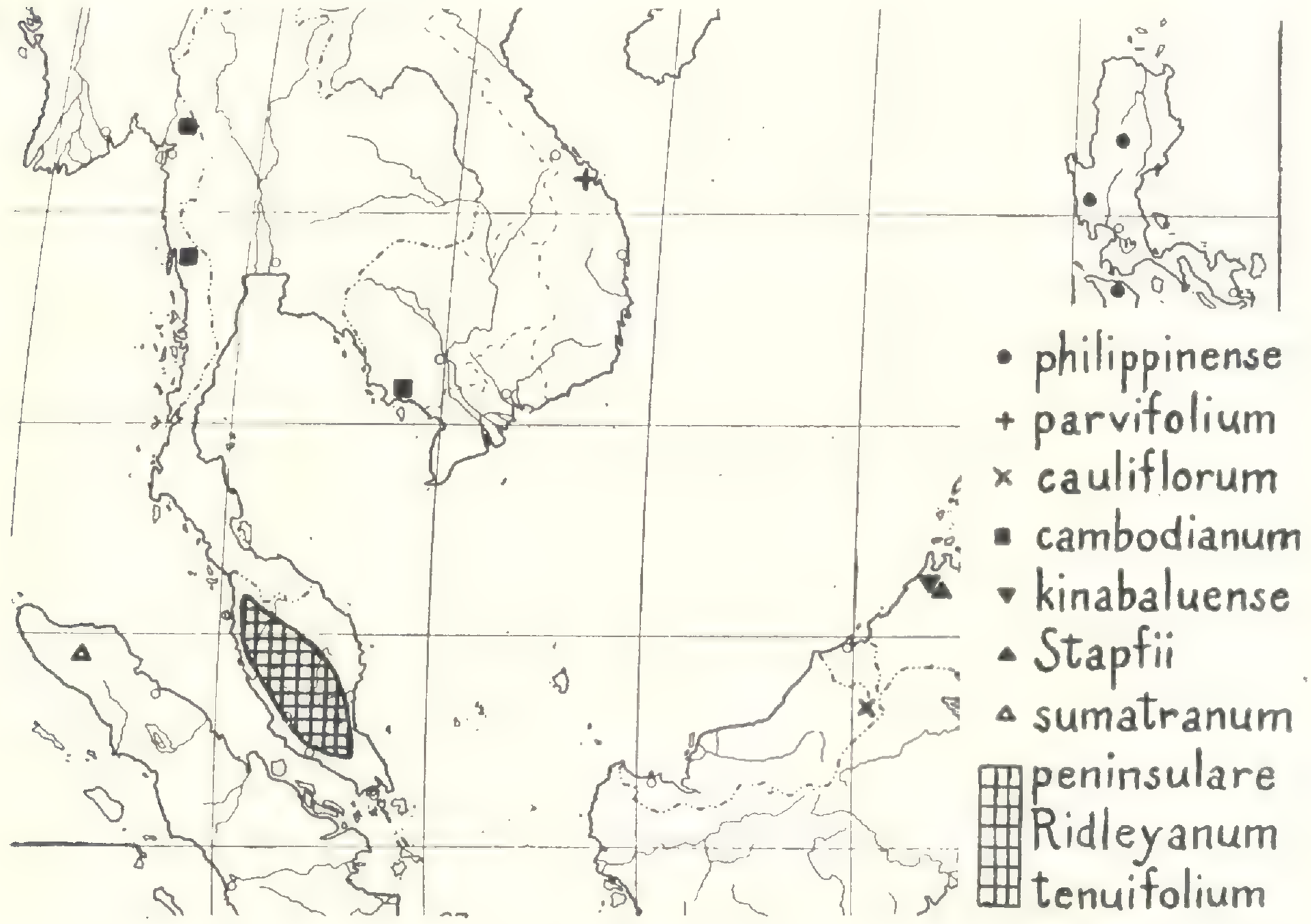

FIG. 9. Approximate known distribution of *Illicium philippinense* (Philippine specimens; for Formosan specimens see *fig. 7*), *I. parvifolium, I. cauliflorum, I. cambodianum, I. kinabaluense, I. Stapfii, I. sumatranum, I. peninsulare, I. Ridleyanum,* and *I. tenuifolium.*

late from a flattened-ovoid ovary, the style 2.5–3 mm. long, acute and often recurved at apex; fruiting carpels (only 1 mature one seen) 13–14 mm. long, 4–5 mm. broad, about 3 mm. thick, gradually attenuate into a slender acumen 4–5 mm. long; seed pale-stramineous, about 5 × 4 × 2 mm.

TYPE LOCALITY: Annam, Indo-China; type, *Clemens 4192,* cited below.

DISTRIBUTION: Known only from the type collection. See map, *fig. 9.*

INDO-CHINA: ANNAM: Mt. Ba Na, near summit, in forest, *J. & M. S. Clemens 4192* (A TYPE, K, M, NY, UC, US), Aug. 16 or 17, 1927.

COLOR NOTES: The perianth-segments are said to be white to pink.

Although, as stated in the original description, this species seems superficially to be related to *I. oligandrum,* of Hainan, actually the two species are not very closely allied. The Hainan species has only 4–7 stamens and usually 8 carpels, characters which remove it from the vicinity of *I. parvifolium.* The latter spe-

cies, indeed, is extremely isolated and apparently without close relatives; perhaps its closest kinship is with *I. cambodianum.*

18. **Illicium** (§ *Cymbostemon*) **cauliflorum** Merr. in Sarawak Mus. Jour. **3**: 522. 1928.

Small tree, flowering at height of 1 m., the young branchlets brownish, lightly angled, 1.5–2 mm. in diameter, the older branchlets grayish, terete, rugulose, 4–6 mm. in diameter; leaves alternate, or in twos or threes at distal nodes; petioles stout (2–2.5 mm. in diameter), 10–15 mm. long; leaf-blades subcoriaceous, dark olivaceous when dried, concolorous, lanceolate-elliptic, 8–11 cm. long, 2.3–4 cm. broad, attenuate at base, short-acuminate at apex, nearly plane at margins, the costa shallowly impressed above, prominent beneath, the secondary nerves about 8 per side, subimmersed on both sides or faintly prominulous above; flowers arising from the branchlets below leaves; pedicels rugulose, slender (0.8–1 mm. in diameter), 10–20 mm. long, obscurely 1- or 2-bracteolate near middle, the bracteoles papyraceous, oblong-deltoid, obtuse, ciliolate, about 1.5 × 1.2 mm.; perianth-segments about 15, papyraceous and ciliolate (except for innermost few), the outermost 5 ovate-deltoid, acute, obscurely pellucid-glandular, 2–2.5 × 2–3 mm., the largest ones oblong-elliptic, 7–8 × 4–5 mm., rounded at apex, the innermost 3 or 4 carnose, oblong, eciliate, 5–6 × 3–4.5 mm.; stamens about 20, regularly arranged in a single series, 1.8–2.2 mm. long, the filaments ligulate, carnose distally, the anthers oblong, 1–1.2 mm. long, the connective papillose, obtuse or faintly emarginate, the thecae introrse-lateral, not protuberant; carpels 11 at anthesis, 3.5–4 mm. long, the ovary flattened-ovoid, greatly thickened dorsally, the style subulate, 1.5–2 mm. long, inflexed at apex.

TYPE LOCALITY: Sarawak, Borneo; type, *Mjöberg 114,* cited below.

DISTRIBUTION: Known only from the type collection, 1900–2400 m. altitude. See map, *fig. 9.*

BORNEO: SARAWAK: Mt. Murud, *E. Mjöberg 114* (UC TYPE), Oct. 1922.

COLOR NOTES: The outer perianth-segments are yellow-green, the inner ones reddish, according to the collector.

This remarkably distinct and geographically isolated species has no close relatives. Such characters as the cauliflorous habit, the distinctly uniseriate stamens with papillose connectives, and the lanceolate-elliptic leaves with obscure venation immediately separate the plant from such continental species as *I. cambodianum* and *I. majus,* the only species with which it can be grouped in a key.

19. **Illicium** (§ *Cymbostemon*) **cambodianum** Hance in Jour. Bot. **14**: 240. 1876.

Illicium cambodgianum Hance ex Pierre, Fl. For. Cochinch. **1**: *pl. 4.* 1879.

Badianifera cambodgiana Kuntze, Rev. Gen. Pl. **1**: 6. 1891.

Illicium Griffithii var. *cambodianum* Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 30. 1905 [repr. Contr. Fl. As. Or. **2**: 30. 1907], in Lecomte, Fl. Gén. Indo-Chine **1**: 31. 1907; Crevost & Pételot in Bull. Econ. Indochine **32**: 21. 1929.

Tree, up to 15 m. high, the young branchlets brown to purpurascent, rugulose, subterete or lightly angled, 2–4 mm. in diameter, becoming grayish and up to 6 mm. in diameter; leaves pseudoverticillate in clusters of 3–5 at distal nodes; petioles stout (1.5–2.5 mm. in diameter), 5–15 mm. long; leaf-blades coriaceous or subcoriaceous, olivaceous to brown and concolorous when dried or slightly paler beneath, broadly elliptic or obovate-elliptic, (6–) 8–13 cm. long (3–) 3.5–6.5 cm. broad, obtuse at base, cuspidate or short-acuminate at apex recurved at margin, the costa slightly impressed above, prominent beneath, the secondary nerves 6–8 per side, spreading, elevated above and obviously anastomosing near margin, elevated to faintly prominulous or subimmersed beneath; flowers axillary or subterminal, solitary or apparently paired, the subtending bracts few, soon caducous; pedicels 25–50 mm. long at anthesis, stout (1.8–2 mm. in diameter

distally), rugulose, ebracteolate; perianth-segments 16–21, the outer ones papyraceous or thin-coriaceous and obscurely ciliolate, the inner ones carnose to thick-carnose and eciliate, the outermost few reniform to broadly ovate, rounded at apex, 3–4.5 × 5–6 mm., the largest ones suborbicular or elliptic-ovate, obviously veined, 11–13 × 10–11 mm., the inner 9–12 segments gradually smaller, the innermost few suborbicular to obovate, 6–9 × 4–7 mm.; stamens 12–18, essentially uniseriate, 3.5–3.8 mm. long, the filaments carnose, ligulate, not contracted at base, 1.5–2 mm. long, the anthers oblong, about equal to filaments in length, the connective truncate, the thecae subprotuberant; carpels 12 or 13 at anthesis, 5–5.5 mm. long, the ovary flattened-triquetrous, 1.8–2 mm. long, the style slender, subulate, 3–3.5 mm. long; fruiting pedicels not much elongating nor thickened, the mature carpels 11–13 in number, 17–22 mm. long, 8–10 mm. broad, 4–5 mm. thick, gradually attenuate into an apex 3–4 mm. long; seed brown, about 8 × 5 × 2.5–3 mm.

TYPE LOCALITY: Cambodge, Indo-China; type, *Pierre 1892* [originally cited without number], of which duplicates are cited below.

DISTRIBUTION: Southern Indo-China and southern Burma, presumably to be expected from Siam; altitudes of 900 and 1050 m. have been recorded. See map, *fig. 9.*

INDO-CHINA: CAMBODGE: Mt. Kamchai (Chaine de l'éléphant), Prov. Kampot, *L. Pierre 1892* (TYPE COLL., A, K, NY), April, 1874.

BURMA: TENASSERIM: Thaton District, Paingkyu to Talé, Dawna Range, *J. H. Lace 4625* (K); Tavoy District, Nwalabo, *R. N. Parker 2312* (K).

LOCAL NAMES and COLOR NOTES: Pierre (in 1879) records the local names of *Dai hôi* (Annamite) and *Dai hôi nui* (Kmer). He notes the flowers as rose-colored and fragrant; flowering specimens were obtained in April (the type) and February (Lace); the Parker specimen, in fruit, was collected in December.

SYNONYMY: As this species is only remotely related to *I. Griffithii,* Finet & Gagnepain's trinomial has no justification.

Of all the specimens available to me, the only ones which appear conspecific with Hance's type collection are the two cited specimens from the Tenasserim Division of Burma. It should be noted that these two specimens were obtained near the type-locality of *I. majus,* but in foliage they appear to agree better with the Cambodian specimen than with Hooker and Thomson's type. The two species are closely allied and distinguishable primarily on characters pertaining to the shape of the leaf-blade and the venation. Neither species has yet been reported from Siam, but the occurrence of both there seems certain.

The few flowers associated with the type-collection of *I. cambodianum* are very immature, and in this condition they were described by Hance. Dissection verifies his observation as to the number of parts, which are as follows: perianth-segments about 16, stamens 12 or 13, and carpels usually 13 (11–13 in fruit). The flowers of *Lace 4625,* fully mature, have the perianth-segments 20 or 21, the stamens 18, and the carpels 13. These differences in number of parts are normal for species of *Illicium.* The floral dimensions given in my description are from the Lace specimen.

From the above data it is obvious that the Malay Peninsula material passing in herbaria and literature as *I. cambodianum* is not of this relationship. Further discussion of the peninsular collections will be found below under *I. peninsulare.*

20. **Illicium** (§ *Cymbostemon*) **majus** Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 40. 1872; Kurz in Jour. As. Soc. Beng. **43** (2): 47. 1874, For. Fl. Brit. Burma **1**: 23. 1877; Maxim. in Bull. Acad. Sci. St. Pétersb. **32**: 480. 1888; King in Ann. Bot. Gard. Calcutta **3**: 201. *pl. 39, A.* 1891.

Illicium maius Hook. f. & Thoms. ex Prantl in E. & P. Nat. Pfl. III. **2**: 19, 1888.

Badianifera major Kuntze, Rev. Gen. Pl. **1**: 6. 1891.

Glochidion Cavaleriei H. Lév. in Rep. Sp. Nov. **12**: 183. 1913, Fl. Kouy-Tchéou 163. 1914, Rev. Ann. Chine 20. 1916.

? Illicium Henryi sensu H. Lév. Fl. Kouy-Tchéou 269 (*Ilicium H.*). 1914; Cheng in Ic. Pl. Omeiens. **1** (1): *pl. 5.* 1942; non Diels.

Illicium Cavaleriei H. Lév. in Le Monde des Plantes II. **18**: 31 (*Ilicium C.*). 1916, Rev. Ann. Chine 23 (*Ilicium C.*). 1916.

Illicium Griffithii sensu Rehder in Jour. Arnold Arb. **17**: 323. 1936; non Hook. f. & Thoms.

Illicium spathulatum Wu in Bot. Jahrb. **71**: 175. 1940.

Shrub or tree up to 20 m. high, the young branchlets brownish or purpurascent, faintly angled or subterete, 1.5–4 mm. in diameter, becoming cinereous, lenticellate, and up to 6 mm. in diameter; apical bud-scales numerous, imbricate, oblong-elliptic, ciliolate, fugacious, the largest ones 10–20 mm. long; leaves irregularly pseudoverticillate at distal nodes in clusters of 3–6; petioles stout, usually 1.5–2.5 mm. in diameter, (8–) 12–20 (–30) mm. long; leaf-blades subcoriaceous, when dried usually dark olivaceous above and brownish beneath or concolorous, oblong-lanceolate or narrowly oblanceolate, (8–) 10–19 (–21) cm. long, (2–) 2.5–6 (–6.5) cm. broad, gradually narrowed toward base, gradually acuminate at apex (acumen usually 8–20 mm. long and callose-apiculate), slightly recurved at margin, the costa shallowly impressed above and prominent beneath, the secondary nerves 6–9 per side; erecto-patent or ascending, faintly raised or nearly plane and anastomosing above, faintly raised or obscure beneath, the minor veinlets sometimes visible above; flowers subterminal or axillary, solitary or in clusters of 2–4, subtended by a few papyraceous deltoid-ovate caducous bracts about 2 × 2 mm.; pedicels 18–45 (rarely to 60) mm. long at anthesis, 1.2–2 mm. in diameter proximally, enlarging distally, rugulose, ebracteolate or rarely with a single minute distal bracteole; perianth-segments (?12–) 15–21, the outer ones papyraceous or submembranaceous, obscurely ciliolate, often pellucid-glandular, the inner ones carnose, eciliate, sometimes glandular, the few outermost ones oblong to broadly deltoid, rounded or obtuse at apex, (1.5–) 5–8 × (3–) 4–7 mm., the largest ones elliptic to obovate-oblong, rounded at apex, 8–15 × 4–9 mm., the innermost 6–10 elliptic-oblong, (4–) 6–10 × (2–) 3–7 mm.; stamens 1- or 2-seriate, 12–21 (–22?), 2.3–4.3 mm. long, the filaments ligulate or subclavate, often carnose and obscurely glandular, 1.1–2.8 mm. long, contracted at base and apex, the connective truncate or faintly emarginate, the thecae protuberant, 1–1.5 mm. long; carpels 11–14 (very rarely 9) at anthesis, (3–) 4–5.5 mm. long, the ovary flattened-ovoid, 1.5–2.5 mm. long, the style slender, subulate, (1.5–) 2.2–3 mm. long; fruiting pedicels not noticeably enlarged, the carpels (as observed) 10–14, 12–25 mm. long, 5–15 mm. broad, 3–5 mm. thick, abruptly narrowed into a conspicuous subulate acumen 3–7 mm. long; seed pale brown, 6–10 × 4.5–7 × 2–3 mm.

TYPE LOCALITY: The exact locality of the type collection of *I. majus* is in some doubt, it having been mentioned as the "Thoung Gain Range" (by Hooker & Thomson and King) or the "Thoungyeen Range" (by Kurz). Accompanying the type specimen (*Lobb*, cited below) is a slip reading "Thoung Gym, Moulmein." Possibly these names refer to Gyaing, east of Moulmein in the Tenasserim Division of Burma on modern maps. The original altitude mentioned by Hooker and Thomson, 5500 ft., would not appear to occur near the lowland modern Gyaing. However, it seems clear that Lobb's specimen came from northern Tenasserim.

DISTRIBUTION: Southern China (western Szechuan, Kweichow, Hunan, and Kwangtung southward) to northern Indo-China and southern Burma; to be expected from Siam. See map, *fig. 10.* A great range of altitudes, from 230 to 2000 m., has been recorded, and the plant is known from such habitats as mixed forest, thickets, dense woods, rocky forested slopes, along streams, etc.

CHINA: KWEICHOW: "Hwei-hsiang-ping," Fan-ching Shan, *A. N. Steward, C. Y. Chiao,* and *H. C. Chao 516* (A, K, NY, US); Mei-t'an, *Y. Tsiang 8049* (NY); P'ing-chou, *Y. Tsiang 7092* (A); Tu-shan, *Y. Tsiang 7047* (NY); P'ing-fa, *J. Cavalerie 578* (A, photo.

and frag. of type of *Glochidion Cavaleriei*), *3849* (K), *7312* (K); "Tung-miao-tsung," Ch'ing-chen, *S. W. Teng 90658* (A). SZECHUAN: O-mei Shan, *T. T. Yü 334* (A); Mu-pin, *E. H. Wilson 3085* (A, K, US). HUNAN: Shih-tzu-yuen, Ch'ang-ning Hsien, *C. S. Fan & Y. Y. Li 345* (A). KWANGTUNG: Lo-ch'ang, *C. L. Tso 20568* (K, NY); Yen-wong-chai, Yao Shan, North River region, *S. S. Sin 9457* (NY). KWANGSI: Ling-yün Hsien, *S. K. Lau 28772* (A); Yeo-mar Shan, N. Hin-yen, *R. C. Ching 7202* (NY); Chen-pien Hsien, *S. P. Ko 55898* (A); "Shuen-yuen" or "Chuen-yuen" Hsien, *Z. S. Chung* [*T. S. Tsoong*] *81625* (A), *81631* (A), *82025* (A); "Tzu-yuen" Hsien, *Z. S. Chung 83457* (A). YÜNNAN: P'ing-pien Hsien, *H. T. Tsai 52514* (A), *55089* (A), *60090* (A), *60260* (A), *60980* (A).

INDO–CHINA: TONKIN: Cha Pa and vicinity, *A. Pételot 1680* (A, NY, UC, US), *3758* (NY, US), *5796* (A, NY, US).

BURMA: TENASSERIM: "Thoung Gym, Moulmein" or "Thoung Gain Range" [vicinity of Gyaing, Thaton District?], *T. Lobb*, in 1857 (K TYPE).

LOCAL NAMES, COLOR NOTES, etc.: The only local name I have located is attached to the Kweichow specimen *Steward et al. 516*, cited above, as *Pa-keh-hwei-hsiang;* the collectors of this specimen state that the fruit is used for seasoning food. The flowers, which mature from April to June, are said to have the perianth-segments red, dark crimson, purplish red, or pinkish red, the outermost segments sometimes being greenish. The fruits are mature from July to October and are reported to be green or reddish green.

SYNONYMY: The type specimen has a single flower, which I have not dissected, but some of the early descriptions based on this specimen are good, indicating the agreement of the type with the bulk of the specimens cited by me. In foliage and in external floral characters the type agrees excellently with the Indo-Chinese material cited, and especially with such a good flowering specimen as *Pételot 5796*.

Glochidion Cavaleriei, later correctly transferred to *Illicium* by Léveillé himself, was based upon a Kweichow specimen cited above (*Cavalerie 578*). This specimen, in fruit, has leaves somewhat smaller than typical for *I. majus*, but I see no way to exclude it, especially since other flowering material collected by Cavalerie at the same place is quite identical with typical *I. majus* from farther south.

Léveillé's reference to *I. Henryi*, in 1914, is based upon specimens from P'ing-fa, Kweichow, collected by Cavalerie and Fortunat, which I have not seen. Probably, however, any specimen from this locality suggestive of *I. Henryi* would prove to represent *I. majus*. Cheng's illustration of an O-mei Shan specimen as *I. Henryi* doubtless portrays the Szechuan form of *I. majus* represented by *Yü 334*, cited above.

In 1936 Rehder, studying the types of Léveillé's woody plants, referred the type of *Glochidion Cavaleriei* to *I. Griffithii*, which in my opinion is a very different species. Most of the Chinese specimens cited by me as *I. majus* are found in herbaria under *I. Griffithii*, a binomial which in common usage has been very laxly applied.

Illicium spathulatum is founded upon three collections by S. S. Sin (nos. *323, 3720, 3903*), presumably deposited in the Berlin herbarium, no duplicates of these being at hand. The type locality is said to be Yao Shan in Kwangsi. Although there is a Yao Shan in eastern Kwangsi, one may question whether Sin's material did not come from the Yao Shan in northern Kwangtung, in the North River region, where he is known to have worked (see the citation of *Sin 9457*, above). At least one species (*I. brevistylum*) is known to me from the Yao Shan in Kwangsi, but Wu's description of *I. spathulatum* seems to exclude this species from consideration. On the other hand, nothing in the original description excludes *I. spathulatum* from *I. majus* as it is represented by Kwangtung material cited by me.

An extremely close relationship between *I. majus* and *I. Henryi* is evident, although the two species fall into different groups in my key on the basis of carpel-number. This single character, indeed, appears to be the most reliable difference between the two entities, although in general the leaf-blades of *I. Henryi* are narrower and have more completely immersed secondaries. Furthermore, the perianth-segments in *I. Henryi* are consistently 10–14, while in *I. majus* they are 15–21. The more southerly specimens of *I. majus* are naturally the most readily distinguished from *I. Henryi*, but it should be mentioned that the most northerly known specimen of *I. majus* (*Wilson 3085*, from western Szechuan) is puzzling. In foliage scarcely distinguishable from *I. Henryi*, this specimen has

all the floral characters of *I. Cavaleriei;* the carpels are usually 13, but in one or two flowers as few as 9 have been observed.

A northwestward extension of the population here under consideration (*I. majus* and *I. Henryi*) has been described above as *I. lanceolatum*, occurring from Kiangsu and Anhwei southward to Kiangsi and Fukien. This latter entity is distinguished from *I. Henryi* (with which it has often been confused in herbaria) by its fewer stamens and more numerous carpels; from *I. majus* it differs in its fewer stamens, fewer perianth-segments, and in its narrower leaf-blades with more completely immersed secondaries.

The three entities discussed above—namely *I. majus, I. Henryi,* and *I. lanceolatum*—form a bloc of species characterized primarily by comparatively narrow and long leaf-blades, very conspicuous subulate styles, and stamens with protuberant thecae. At full anthesis the thecae tend to open very widely, the inner

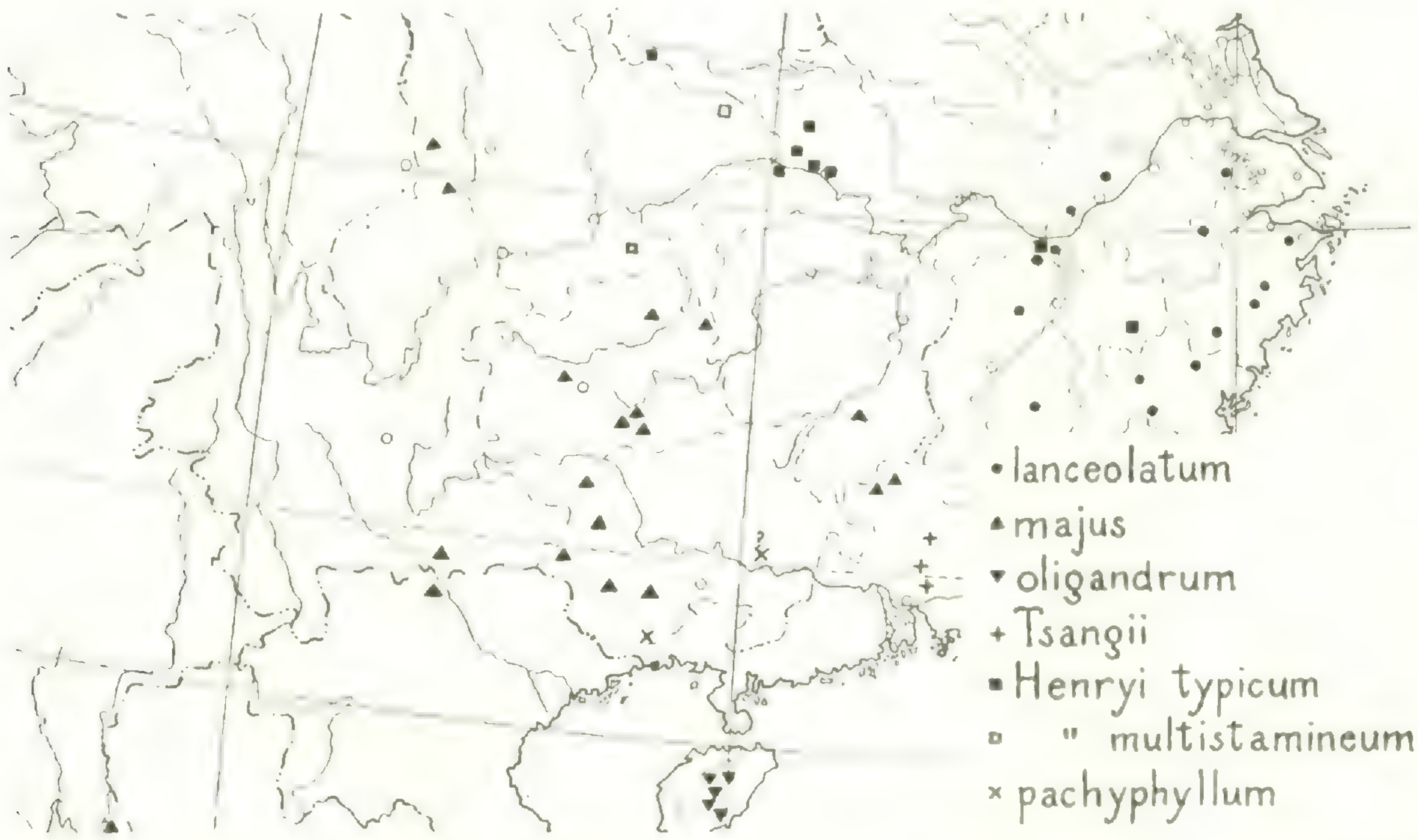

FIG. 10. Approximate known distribution of *Illicium lanceolatum, I. majus, I. oligandrum, I. Tsangii, I. Henryi,* and *I. pachyphyllum.*

valves remaining adnate while the outer valves are widely spread; this type of anther is quite characteristic for these three species. Each of the three entities has a fairly distinct geographical range. In the writer's opinion the differences between them, although slight, coupled with their more or less disjunct distributions, indicate specific status; other students may as logically consider these three entities only subspecific in nature.

21. **Illicium** (§ *Cymbostemon*) **brevistylum** sp. nov.

Frutex vel arbor ad 10 m. alta, ramulis rugulosis subteretibus, juventute brunneis vel purpurascentibus 1–3 mm. diametro, vetustioribus cinereis valde incrassatis; squamis lanceolatis mox caducis, maximis 5–8 mm. longis; foliis 3–5 ad nodos distales aggregatis, petiolis 6–20 mm. longis 1–2 mm. diametro; laminis coriaceis siccitate supra fusco-viridibus vel brunneis subtus brunnescentibus, anguste oblongo-ellipticis vel oblanceolatis, (5–) 7–14 cm. longis, (1.5) 2–4.5 (–5) cm. latis, basi attenuatis, superne in apicem 5–10 mm. longum acutum saepe cal-

losum abrupte acuminatis, margine recurvatis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 5–8 erecto-patentibus utrinque immersis vel planis vel leviter elevatis; floribus axillaribus vel subterminalibus, bracteis basalibus paucis mox caducis; pedicellis 1–2 mm. diametro teretibus sub anthesi (8–) 10–16 mm. longis ut videtur ebracteolatis; segmentis perianthii 9–11 interdum obscure glandulosis, exterioribus papyraceis minute ciliolatis, interioribus carnosis eciliatis, extimis 2–4 late ovatis vel oblongo-ellipticis, 3–7 × 5–7 mm., maximis suborbicularibus 6–11 mm. longis et latis, intimis elliptico-oblongis vel obovatis 4–6 × 2.5–6 mm.; staminibus 1- vel 2-seriatis 14–20 oblongis sub anthesi 1.9–3.4 mm. longis, filamentis carnosis ligulatis 0.9–1.9 mm. longis utrinque paullo angustatis, connectivo truncato, thecis protuberantibus 0.8–1.6 mm. longis; carpellis sub anthesi 12 vel 13, 2.3–3.4 mm. longis, ovario complanato-oblongo 1.5–2.2 mm. longo in stylum conico-subulatum 0.8–1.2 mm. longum angustato; pedicellis sub fructu saepe 16–35 mm. longis et paullo incrassatis, carpellis maturis 11–13 oblongis, 13–17 mm. longis, 6–10 mm. latis, 3–4 mm. crassis, in acuminem crassum inconspicuum 1–3 mm. longum angustatis; semine pallide brunneo maturitate 6–7 × 4.5–5 × 2.5–3 mm.

TYPE LOCALITY: Yao Shan, Kwangsi; type, *Wang 40122,* cited below.

DISTRIBUTION: Southeastern China, in southern Hunan, eastern Kwangsi, and Kwangtung. See map, *fig. 12.* Habitats such as forests, thickets, mixed woods, and rocky places have been recorded; although none of the specimens bear altitudinal notes, the species is apparently restricted to mountainous regions.

CHINA: HUNAN: P'ing-t'ou Shan, Pai-mu Village, I-chang Hsien, *W. T. Tsang 23516* (A, US). KWANGTUNG: Maan-chi [Wan-chi] Shan, Jen-hua Hsien, *W. T. Tsang* (C. C. C.) *8736* (Man, NY); same general region, Shek-pik-ha Village, *W. T. Tsang 26260* (A); Lo-ch'ung, *C. L. Tso 20231* (NY); Fen-shiu Shan, Weng-yüan Hsien, *S. K. Lau 2627* (A); Naam-kwan Shan, Tseng-ch'eng Hsien, *W. T. Tsang 20099* (A, K, M, NY, US), *20397A* (A, K, M, NY, US); Wan-tong Shan, Taai-tsan, Ying-te Hsien, *W. T. Tsang & K. C. Wong* (C. C. C.) *14522* (UC). KWANGSI: Yao Shan, P'ing-nan Hsien, *C. Wang 39210* (A), *40122* (A TYPE), Oct. 14, 1936, *40132* (A).

LOCAL NAME, etc.: The only local name recorded is *Ye-paat-kok,* by Tsang in Kwangtung. No flower colors are given, but one may suspect that the perianth-segments are reddish. Apparently seasons are not well defined in this population, for I have seen flowering records in April, May, and October, and fruiting records in October, November, April, and May.

This species and the following, both new, appear to be sharply distinguished by their very short styles from other species with similar numbers of carpels and stamens, such as *I. majus.* Possibly derived from the complex of species discussed above under *I. majus,* these two entities cannot logically be referred to any described species.

22. **Illicium** (§ *Cymbostemon*) **modestum** sp. nov.

Frutex vel arbor ad 3 m. alta, ramulis gracilibus teretibus rugulosis cinereis apicem versus circiter 2 mm. diametro; foliis ad nodos distales binis vel ternatis, petiolis 4–7 mm. longis 1–1.5 mm. diametro; laminis subcoriaceis in sicco supra fusco-viridibus subtus brunnescentibus, anguste oblongo-ellipticis, (4–) 5–7.5 cm. longis, (1.5–) 2–2.5 cm. latis, basi acutis, apice gradatim angustatis et breviter acuminatis, margine anguste recurvatis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 5–7 brevibus erecto-patentibus utrinque leviter prominulis marginem versus anastomosantibus; floribus subterminalibus solitariis vel binis, bracteis basalibus paucis minutis; pedicellis rugulosis sub anthesi 9–17 mm. longis et 1.5 mm. diametro superne incrassatis ebracteolatis; segmentis perianthii circiter 19 omnino papyraceis plus minusve glandulosis, extimis 3 subreniformibus vel late deltoideis ciliolatis 1.5–2 × 2.8–4 mm., maximis ellipticis vel oblongo-ellipticis 8–9 × 5–6 mm., intimis angustatis 4–7 × 2–3 mm.; staminibus circiter 17 biseriatis sub anthesi 2.7–3 mm. longis, filamentis carnosis obscure

FIG. 11. *Illicium* § *Cymbostemon*. *a–g*. *I. lanceolatum*: *a*. flowering branchlet, × ½; *b*. flower, × 1; *c*. flower with perianth-segments removed, × 3; *d*. stamen, extrorse view, × 3; *e*. stamen, introrse view, × 3; *f*. carpel, × 3; *g*. longitudinal section of carpel, × 3. *h–l*. *I. Tsangii*: *h*. flowering branchlet with larger leaf, × ½; *i*. perianth-segments arranged (left to right) from outermost to innermost, × 1; *j*. stamen, extrorse view, × 3; *k*. stamen, in-

pellucido-glandulosis 1.5–1.8 mm. longis utrinque paullo angustatis, connectivo inconspicuo truncato, thecis protuberantibus 1.2–1.3 mm. longis; carpellis sub anthesi circiter 12, 2.8–3.2 mm. longis, ovario complanato-ovoideo 1.4–1.6 mm. longo in stylum conico-subulatum subaequilongum angustato.

TYPE LOCALITY: Yünnan; type, *Wang 75376*, cited below.

DISTRIBUTION: Known only from the type collection, which came from forested mountain-slopes at 1900 m. altitude. Although I have not been able to find the cited locality "Nan-chiao," it seems possible that this refers to the Nan-kiao-ho (River), in the general region visited by Wang in the season concerned. See map, *fig. 12.*

CHINA: YÜNNAN: Nan-chiao, *C. W. Wang 75376* (A TYPE), June 1936.

COLOR NOTES: The flowers are reported as green, with yellow anthers, but it seems more likely that the yellow portion refers to the inner perianth-segments. The young fruits are green.

This new species appears closely related to the preceding, from which it differs, as indicated in my key, in the more numerous perianth-segments and smaller leaves. *Illicium modestum* is perhaps more closely allied to *I. micranthum,* also from Yünnan, than implied by its position in this treatment. However, the new species has slightly the larger flowers, its perianth-segments are not so sharply differentiated into an outer and an inner series on the basis of texture, its stamens are about 17 rather than 10–12, and its carpels are about 12 rather than 6–8. In foliage and carpel-shape, *I. modestum* and *I. micranthum* are suggestively similar.

23. **Illicium** (§ *Cymbostemon*) **Griffithii** Hook. f. & Thoms. Fl. Ind. **1:** 74. (Feb.?) 1855; Drury, Hand-book Ind. Fl. **1:** 15. 1864; Baill. Hist. Pl. **1:** 154. 1868–69; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1:** 40. 1872; Thiselton-Dyer in Jour. Linn. Soc. Bot. **13:** 331. 1873; Maxim. in Bull. Acad. Sci. St. Pétersb. **32:** 480. 1888; King in Ann. Bot. Gard. Calcutta **3:** 201. *pl. 40, A.* 1891; Parment. in Bull. Sci. Fr. & Belg. **27:** *222, 297.* 1896; Brandis, Indian Trees 9. 1906; ? Finet & Gagnep. in Lecomte, Fl. Gén. Indo-Chine **1:** 31. *f. 6 (4–6).* 1907; Kanj., Kanj., & Das, Fl. Assam **1:** *27.* 1935.

? Gordonia terminalis Wall. Cat. *242* (no. 7172), nomen. 1832.

Ternstroemia khasyana Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14:** 108. (late) 1855; Thiselton-Dyer in Jour. Linn. Soc. Bot. **13:** 331, as synonym. 1873.

Illicium Grifithii Hook. f. & Thoms. ex Walp. Ann. Bot. **4:** 42. 1857.

Badianifera Griffithii Kuntze, Rev. Gen. Pl. **1:** 6. 1891.

Small tree, the young branchlets brownish, subterete, strongly rugulose when dried, 2–3 mm. in diameter, becoming cinereous and up to 6 mm. in diameter; leaves irregularly alternate or in clusters of 3–5 at distal nodes; petioles 7–17 mm. long, 1–1.5 mm. in diameter; leaf-blades coriaceous, when dried dark green or dark olivaceous above and brownish beneath, oblong-elliptic or narrowly obovate-elliptic, (6–) 7–13 cm. long, 2–5.3 cm. broad, acute at base, gradually acuminate to a slender callose-acute apex, narrowly revolute at margin, the costa sharply impressed above, prominent beneath, the secondary nerves 7–10 per side, erecto-patent, fairly straight, subimmersed or faintly raised above, raised or sharply prominulous beneath, obscurely anastomosing; flowers axillary or subterminal, solitary or in clusters of 2 or 3, subtended by a few minute fugacious bracts; pedicels strongly rugulose, stout (1.3–2.3 mm. in diameter), 10–20 mm. long at anthesis, ebracteolate; perianth-segments 25 or 26, sometimes obscurely pellucid-glandular, the outer ones papyraceous to thin-coriaceous and faintly ciliolate, the

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trorse view, × 3; *l.* gynoecium with some carpels removed, showing four carpels and the extension of the torus, × 3. *m–r. I. micranthum: m.* flowering branchlet, × ½; *n.* stamen, extrorse view, × 3; *o.* stamen, introrse view, × 3; *p.* gynoecium with some carpels removed, showing four carpels and the extension of the torus; *q.* fruit, × 1; *r.* seed, × 1. *s–v. I. ternstroemioides: s.* fruit, × 1; *t.* mature carpel, × 1; *u.* longitudinal section of carpel, × 1; *v.* seed, × 1. *Figs. a–g* drawn from *Chen 3171; h–l* from *Tsang 20397; m–p* from *Henry 12224A; q, r* from *Henry 12224C; s–v* from *Chun & Tso 43783.*

inner ones carnose and eciliate, the outermost few broadly ovate-suborbicular, 3.5–4.5 × 5–6 mm., the largest ones suborbicular, 7–10 mm. long and broad, the innermost ones (about 10) oblong-obovate, 4–5 × 2.5–3 mm.; stamens usually 2-seriate, about 30, 2.3–2.7 mm. long, the filaments carnose, ligulate, subterete distally, 1.1–1.4 mm. long, the connective thickened, subtruncate, the thecae protuberant, 1–1.4 mm. long; carpels 12 or 13, 4–4.5 mm. long at anthesis, the ovary broadly flattened-ellipsoid, about 1.5 mm. long, much exceeded by the slender subulate style, this 2.5–3 mm. long, often reflexed distally; fruiting pedicels not much thickened, up to 15–47 mm. long at maturity, the carpels 12 or 13, broadly flattened-ovoid, 14–20 mm. long, 8–10 mm. broad, 3–5 mm. thick, abruptly attenuate into a subulate acumen 3–5 mm. long; seed castaneous or brown, about 7 × 5 × 2–2.5 mm.

TYPE LOCALITY: Khasi Hills, Assam; type, *Griffith 62* (or *626*) [originally cited without number], cited below.

DISTRIBUTION: Assam and Bhutan, in northeastern India, at elevations of about 1200 to 2000 m., in dense wet forest. See map, *fig. 12.*

INDIA: ASSAM: Harikanni Hill, Naga Hills, *A. Meebold 9262* (K); Paona, Naga Hills, *N. L. Bor 2685* (K); Khasi Hills, *W. Griffith 7* (NY), *62* (or *626*) (GH, K TYPE) ["Mamloo, near Churra," ex Hook. f. & Thoms.], *422* (type coll. of *Ternstroemia khasyana,* K), *s. n.* (K); "Kala-pani," Khasi Hills, *W. Griffith* (K), *J. D. Hooker & T. Thomson,* June 17, 1850 (GH, K, NY). BHUTAN: Without locality, *E. M. Holmes,* Dec. 1880 (K).

USES, etc.: Kanjilal et al. (1935) report that the flowers are aromatic and that the plant has carminative properties. Mature flowers have been collected in April and May and mature fruits in December, but no color notes are available.

SYNONYMY: Although this binomial has been applied to numerous specimens in herbaria and has been accredited with a wide range in the literature, it actually seems to cover a well-defined and restricted concept. Some of the misapplications of the binomial will be found cited in synonymy throughout the present paper.

The binomial *Gordonia terminalis* Wall., a *nomen nudum,* is based on *Wallich 7172* from Sylhet, Assam, a specimen not available to me. The binomial is included in the synonymy of *I. Griffithii* on King's authority.

Ternstroemia khasyana is based upon *Griffith 422,* in the Boissier Herbarium; a duplicate, at Kew, is cited above. Thiselton-Dyer's note of 1873, cited above, refers this binomial to *I. Griffithii.* As Choisy's publication and Hooker & Thomson's were in the same year, it must be noted that the binomial *I. Griffithii* seems to have priority. In this connection, see Merrill's note in Brittonia **4**: 53. 1941. As a matter of fact, the Griffith specimens which I have cited above under nos. *7, 62,* and *422* are so similar that it seems possible that they are all parts of the same collection, subsequently diversely numbered.

Most of the earlier descriptions of *I. Griffithii,* even those based exclusively on material from India by Hooker & Thomson, Maximowicz, and King, state that the perianth-segments are 18–25, the stamens 20–24, and the carpels 12–15. From the flowers which I have examined, including those of the type collection, I find these parts to number: perianth-segments 25 or 26, stamens about 30, and carpels 12 or 13. Therefore I assume that disagreeing statements may be based on inadequate observation.

As thus delimited and as described above, *I. Griffithii* is an excellently marked species, with affinities farther east in Asia in *I. leiophyllum, I. arborescens,* and *I. ternstroemioides.* It is obvious that herbarium identifications in *Illicium* based upon superficial examination of foliage and external floral characters are grossly inadequate.

24. **Illicium** (§ *Cymbostemon*) **leiophyllum** sp. nov.

Illicium Griffithii sensu Dunn & Tutcher in Kew Bull. Add. Ser. **10**: 28. 1912; Herklots in Hong Kong Nat. **4**: 21. 1933; non Hook. f. & Thoms.

Frutex 3–4 m. altus, ramulis hornotinis brunneis leviter angulatis vel subteretibus 2–3 mm. diametro, vetustioribus cinereis ad 5 mm. diametro; squamis ovatis

ad 5 mm. longis mox caducis; foliis 3–5 ad nodos distales aggregatis, petiolis 8–17 mm. longis 1.5–2 mm. diametro; laminis coriaceis in sicco supra fusco-viridibus subtus olivaceis, oblongo-ellipticis, (6–) 8–13 cm. longis, (2–) 2.5–4 cm. latis, basi attenuatis et in petiolum longe decurrentibus, superne in apicem brevem calloso-acutum acuminatis, margine leviter recurvatis, costa supra peracute impressa subtus prominente, nervis secundariis utrinescus 6–9 subpatentibus immersis et haud visibilibus vel utrinque minute elevatis; floribus axillaribus vel subterminalibus 2–4 aggregatis, bracteis subtendentibus pluribus papyraceis late ovatis ad 2 × 4 mm.; floribus juvenilibus solis visis, pedicellis ante anthesin crassis brevibus; segmentis perianthii 21–23, exterioribus papyraceis scarioso-marginatis ciliolatis, interioribus carnosis eciliatis, extimis 3 vel 4 suborbculari-deltoideis 4–5 mm. longis et latis, maximis late ellipticis in alabastro 5–6 mm. longis, intimis obovatis in alabastro ad 2.5–4 × 1–2 mm. reductis; staminibus 2- vel 3-seriatis 29 vel 30 in alabastro 1.5–1.8 mm. longis, filamentis carnosis leviter complanatis, connectivo parce luteo-glanduloso obtuso vel paullo emarginato, thecis leviter

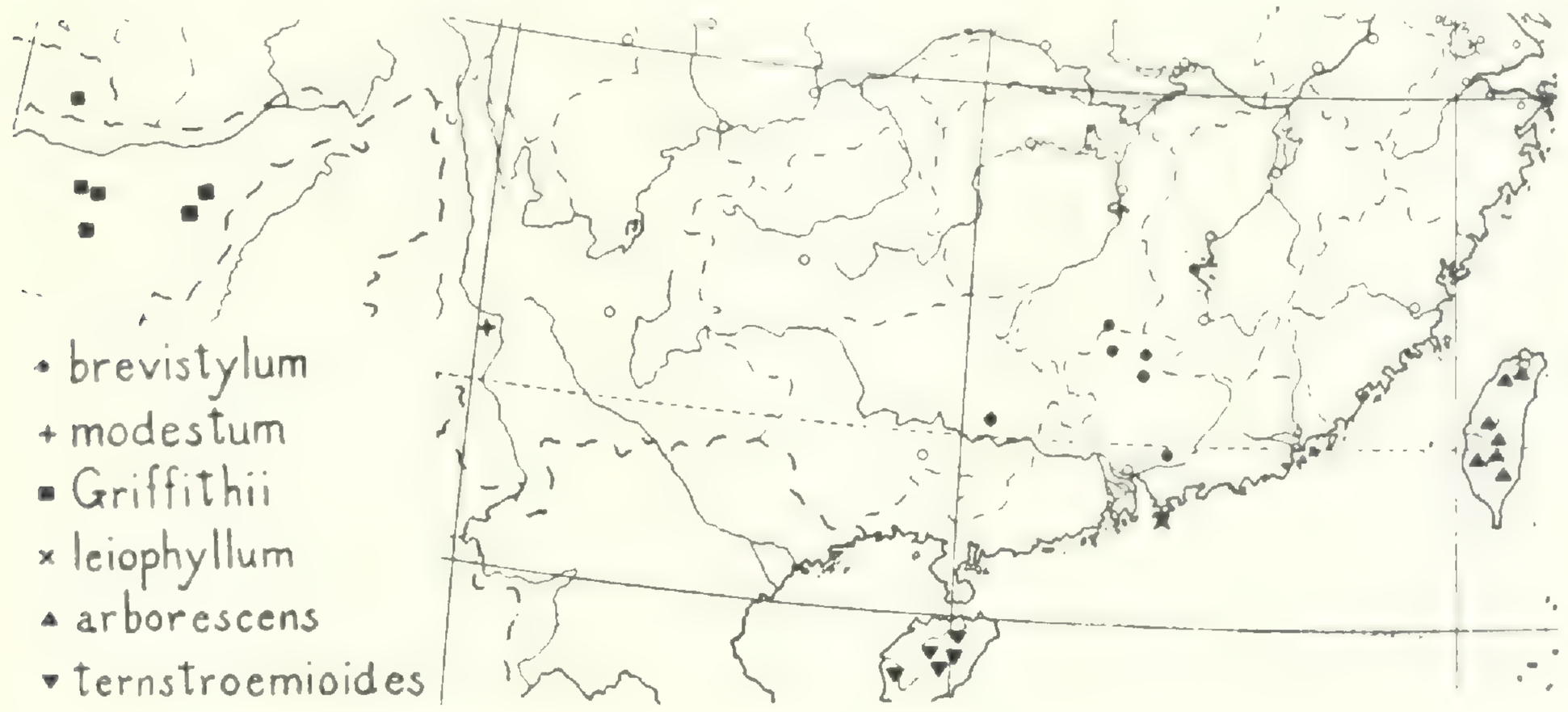

FIG. 12. Approximate known distribution of *Illicium brevistylum, I. modestum, I. Griffithii, I. leiophyllum, I. arborescens,* and *I. ternstroemioides.*

protuberantibus in alabastro 0.8–1 mm. longis; carpellis 11 vel 12 in alabastro minutis, stylo conico-subulato quam ovario ut videtur leviter breviore; pedicellis sub fructo teretibus rugulosis 20–25 mm. longis superne ad 3 mm. diametro, carpellis 11 vel 12 oblongis, 11–19 mm. longis, 5–7 mm. latis, 3–4 mm. crassis, in acuminem cuspidatum gradatim angustatis.

TYPE LOCALITY: Hongkong; type, *Tutcher 4661,* cited below.

DISTRIBUTION: Known only from the type collection, from clefts of rocks on steep banks; altitude not stated. See map, *fig. 12.*

CHINA: HONGKONG: Mt. Nicholson, *W. J. Tutcher* (Herb. Hongk.) *4661* (A TYPE), Dec. 31, 1906.

SYNONYMY: The locality mentioned by Dunn & Tutcher and by Herklots under *I. Griffithii* is Mt. Nicholson, and I assume that they had the same collection as I.

Although the relationship of this new species is obviously with *I. Griffithii,* it differs from Indian material in foliage, in number of perianth-parts, and in carpel proportions, as stated in my key. Only young flowers are available, but the species seems amply distinct to me.

25. **Illicium** (§ *Cymbostemon*) **arborescens** Hayata, Ic. Pl. Formos. **2**: 105. 1912, **9**: 1. *f. 1.* 1920; Nakai in Bot. Mag. Tokyo **36**: 120. 1922; Sasaki, Cat. Gov. Herb. (Taihoku) 215. 1930; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 353. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936; Kanehira, Formosan Trees 187. *f. 136* (excl. *B*); *pl. 36.* 1936.

Illicium sp. Hayata in Jour. Coll. Sci. Tokyo **25**: 45. 1908.

Tree, up to 15 m. high, the branchlets usually cinereous, rugulose, subterete or when young irregularly lightly angled, 1.5–3 mm. in diameter toward apices; bud-scales oblong, up to 3 mm. long; leaves laxly alternate or in clusters of 3–5 at distal nodes; petioles 8–17 (–20) mm. long, 0.8–2 mm. in diameter; leaf-blades coriaceous or thin-coriaceous, brown when dried or dark green above, narrowly oblong- or obovate-elliptic, 6–12 (–14) cm. long, (1.5–) 2–4.5 (–5.5) cm. broad, acute at base, acuminate (apex often conspicuous, up to 10 mm. long, callose-acute), narrowly recurved at margin, the costa impressed above and prominent beneath, the secondary nerves 5–8 per side, subspreading, immersed or prominulous above, usually obviously prominulous and obscurely anastomosing beneath; flowers axillary or subterminal, solitary or in clusters of 2 or 3, the subtending bracts few, papyraceous, ovate-deltoid, caducous, up to 3 × 4 mm.; pedicels stout (1–2 mm. in diameter), 5–22 mm. long at anthesis, ebracteolate or rarely with a single inconspicuous bracteole; perianth-segments 14–21, often obviously glandular, the outer ones papyraceous and obscurely ciliolate, the inner ones thick-papyraceous to carnose and eciliate, the outermost few suborbicular-reniform, 3–7 ×4–8 mm., the next few suborbicular or broadly elliptic and becoming larger, the largest ones obovate-oblong, 8–12 × 5–9 mm., the innermost 2–6 reduced to 5–7 × 2–3 mm.; stamens usually 3-seriate, 39–41, oblong, 2.5–3 mm. long, the filaments carnose, ligulate, narrowed proximally, 1.2–1.7 mm. long, the connective truncate or slightly emarginate, the thecae slightly protuberant, 1–1.5 mm. long; carpels 12–16 at anthesis, 2–3.8 mm. long, the ovary flattened-ellipsoid, 1–1.8 mm. long, the style subulate, slightly exceeding the ovary in length (1–2 mm. long), obscurely stigmatic distally; fruiting pedicels not much enlarged, 15–30 mm. long, the carpels (10–) 12–14, elongate-ovoid, 15–18 mm. long, 6–7 mm. broad, 3–4 mm. thick, gradually attenuate to an acumen 3–5 mm. long; seed stramineous, 6–9 × 4.5–6 × 1.5–2 mm.

TYPE LOCALITY: Formosa; type, *Hayata & Sasaki,* Jan. 1912, of which a duplicate is cited below.

DISTRIBUTION: Formosa, in forests at elevations up to 2500 m. and probably not much lower than 1000 m.; said to be common locally. See map, *fig. 12.*

FORMOSA: Kankô, Taihoku, *R. Kanehira 3095* (NY); vicinity of Hesinhi, Prov. Taihoku, *E. H. Wilson 10238* (A); Tentana, Shinchiku, *E. H. Wilson 10301* (A, K, US); vicinity of Horisha, Prov. Nanto, *E. H. Wilson 9930* (A, K, Man); slopes of Mt. Rantai [Randai], Daksui Valley, *W. R. Price 202* (K); between Karapin and Funkiko [region of Mt. Arisan], *B. Hayata & S. Sasaki,* Jan. 1912 (TYPE COLL., K); Mt. Arisan, Prov. Kagi, *E. H. Wilson 9712* (A, K, US), *U. Faurie 1535* (A); Rengeti, Taityu Prov., *R. Kanehira 21306* (A, NY, UC); Paiwan, *E. Matuda 272* (A); Hokuzan-ko, *R. Kanehira & S. Sasaki 528* (UC).

LOCAL NAME and COLOR NOTES: Kanehira (1936) has recorded the name *Akabana-sikimi* for this species. The flowers mature from January to April and have red or pale red perianth-segments; mature fruits have been collected in October.

On the basis of foliage it would be difficult to distinguish between this species and several of its allies, but *I. arborescens* seems amply characterized by its many stamens, which are more numerous than in any other species of § *Cymbostemon.*

26. **Illicium** (§ *Cymbostemon*) **peninsulare** sp. nov.

Illicium cambodianum sensu King in Jour. As. Soc. Beng. **58** (*2*): 374, p. p. 1889, in Ann. Bot. Gard. Calcutta **3**: 200, p. p. *pl. 38, B* (*f. 1, 2, 5*). 1891; Ridley, Fl. Malay Penins. **1**: 18, p. p. *f. 4* (fr.). 1922; Burkill & Holttum in Gard. Bull. Straits Settlem. **3**: 33, p. p. 1923; Burkill, Dict. Econ. Prod. Mal. Penins. 1225, p. p. 1935; non Hance.

Illicium cambodianum var. *crassifolia* (sic) Ridley, Fl. Malay Penins. 1: 19, p. p. 1922.

Arbor parva, ramulis subteretibus inconspicue rugulosis nodis incrassatis, hornotinis brunneis 2–3 mm. diametro, annotinis cinerascentibus subvalidis; squamis parvis subcoriaceis ovatis ad 3 mm. longis fugacibus; foliis suboppositis vel ad nodos distales 3 vel 4 aggregatis; petiolis valde rugulosis 10–27 mm. longis 1–2 mm. diametro; laminis coriaceis in sicco utrinque fusco-olivaceis, ellipticis vel obovato-ellipticis, 8–17 cm. longis, 4–9 cm. latis, basi obtusis, apice calloso-acuto cuspidatis margine anguste recurvatis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 6–10 subpatentibus utrinque paullo elevatis inconspicue anastomosantibus; floribus axillaribus vel subterminalibus, bracteis basalibus pluribus minutis papyraceis ovato-suborbicularibus ad 1 mm. longis; pedicellis sub anthesi 10–25 mm. longis inferne 0.6–1.3 mm. diametro superne incrassatis ebracteolatis; segmentis perianthii circiter 19 (vel paucioribus?), exterioribus papyraceis vel tenuiter coriaceis minute ciliolatis, interioribus carnosis eciliatis, extimis 2–4 deltoideo-ovatis 1.5–2.5 × 2–4 mm., maximis suborbicularibus submaturis ad 7–9 mm. longis latisque, intimis 5–7 valde reductis oblongis vel lanceolatis 4–5 × 1.5–3 mm.; staminibus 2- vel 3-seriatis plerumque 31–33 submaturis 2.5–3 mm. longis, filamentis carnosis ligulatis quam antheris brevioribus, antheris oblongis 1.6–2.1 mm. longis, connectivo obtuso, thecis subprotuberantibus; carpellis sub anthesi 13 vel 14, 3.5–4 mm. longis, ovario complanato-ovoideo circiter 1.5 mm. longo, stylo saepe 2 mm. longo subulato; pedicellis sub fructu 20–40 (interdum ad 95) mm. longis; carpellis maturis 11–14, submaturis 12–14 mm. longis, 7–8 mm. latis, 3.5–4.5 mm. crassis, in acuminem circiter 2 mm. longum incurvum abrupte angustatis; semine stramineo 5.5 mm. longo vel majore.

TYPE LOCALITY: Pahang, Malay Peninsula; type, *Nur 11247*, cited below.

DISTRIBUTION: Malay Peninsula, at elevations of 450 to 1300 or possibly 2000 m., in forests. See map, *fig. 9*.

MALAY PENINSULA: PERAK: *B. Scortechini* in part (US). PAHANG: Fraser Hill, Selangor border, *M. Nur 11247* (A TYPE, UC), Sept. 21, 1923, *I. H. Burkill & R. E. Holttum 8444* (A); Sunju Ichat, *Forest Dept.* (coll. *Ja'amat*) *27551* (K). SELANGOR: Sempang, *H. N. Ridley 15691* (K); Bukit Kutu, *H. N. Ridley 7218* (K). JOHORE: Gunong Panti, *E. J. H. Corner 29213* (K).

LOCAL NAME and COLOR NOTES: Burkill & Holttum's mention (in 1923) of *Bakau bukit* (hill mangrove, because its red wood suggests mangrove wood) probably refers to the present species. Burkill (in 1935) states that the timber of *Bakau bukit* is used but is not important. The flowers are said to be claret and to have the odor of anise (by Burkill & Holttum). Seasonal dates are not well fixed; I have seen flowering specimens taken in April and September, and fruiting specimens in March and August.

In the literature pertaining to the occurrence of *Illicium* in the Malay Peninsula, authors (King, Ridley, and others) have accredited to that region *I. cambodianum*, commenting on the variability of that species. I am unable to agree with this, *I. cambodianum* being quite well marked by a combination of characters and apparently not occurring farther south than Indo-China and Burma. The Malay Peninsula material appears to me to represent three species; of these, the entity most readily confused with true *I. cambodianum* is *I. peninsulare*, which similarly has broad coriaceous leaf-blades and numerous carpels. Although the two species fall into different groups in my key, they may indeed be more closely related than this indicates. The following supplementary key may be used to separate them:

Petioles 5–15 mm. long, stout (1.5–2.5 mm. in diameter); pedicels comparatively stout, 1.5–2 mm. in diameter at anthesis; largest perianth-segments carnose, 11–13 mm. long at anthesis; stamens 12–18, essentially uniseriate, the anthers subequal to the filaments in length; carpels at anthesis 5–5.5 mm. long, with a style 3–3.5 mm. long.
19. *I. cambodianum*.

Petioles 10–27 mm. long, 1–2 mm. in diameter; pedicels comparatively slender, 0.6–1.8 mm. in diameter at anthesis; largest perianth-segments papyraceous, 7–9 mm. long at anthesis, only the innermost segments carnose; stamens 31–33, 2- or 3-seriate, the anthers exceeding the filaments in length; carpels at anthesis 3.5–4 mm. long, with a style about 2 mm. long ..... 26. *I. peninsulare*.

Foliage differences between the two entities are not obvious, but Prof. Bailey informs me that the leaves of *I. cambodianum* (at least the type collection) have the sclereids abundant and diffused, whereas those of *I. peninsulare* have no sclereids.

The other two species occurring in the Malay Peninsula have comparatively few carpels and therefore fall into Group II of § *Cymbostemon* in my key. Nevertheless the following comparison may prove useful in differentiating the three species:

SUPPLEMENTARY KEY TO THE SPECIES OF § CYMBOSTEMON KNOWN TO OCCUR IN THE MALAY PENINSULA

Outermost perianth-segments scarcely smaller than those of the middle series, usually 7–9 mm. long; perianth-segments 8–13; stamens 10–14, 3.5–4.2 mm. long, the filaments about twice as long as the anthers; carpels (5–) 7–9; leaf-blades coriaceous, elliptic, usually 5–10 cm. long ..... 35. *I. Ridleyanum*.

Outermost perianth-segments greatly reduced, bracteole-like, 1–2.5 mm. long; perianth-segments 11–19; stamens less than 3.5 mm. long, the filaments not much, if at all, exceeding the anthers in length; leaf-blades usually 8–19 cm. long.

Stamens 11–16, the anthers 0.8–1.4 mm. long; carpels 5–8; leaf-blades usually chartaceous to papyraceous ..... 37. *I. tenuifolium*.

Stamens 31–33, the anthers 1.6–2.1 mm. long; carpels (11–) 13 or 14; leaf-blades coriaceous ..... 26. *I. peninsulare*.

27. **Illicium** (§ *Cymbostemon*) **ternstroemioides** sp. nov.

Illicium sp. Groff, Ding, & Groff in Lingn. Agr. Rev. **1** (2): 82. 1923; Merr. in Lingnan Sci. Jour. **5**: 76. 1927.

Illicium Griffithii sensu Tanaka & Odashima in Jour. Soc. Trop. Agr. Taihoku **10**: 366. 1938; non Hook. f. & Thoms.

Arbor ad 12 m. alta, ramulis rugulosis subteretibus plerumque cinereis, hornotinis gracilibus saepe leviter angulatis 1.5–2.5 mm. diametro, vetustioribus 3–5 mm. diametro; foliis 3–5 nodos distales laxe aggregatis; petiolis 7–20 mm. longis 1–2.5 mm. diametro; laminis coriaceis in sicco plerumque supra fusco-viridibus et subtus pallide brunneis, oblongo-ellipticis vel oblanceolatis vel anguste obovatis, (7–) 8–13 (–15) cm. longis, (1.5–) 2–5 (–6.5) cm. latis, basi attenuatis, in acuminem 5–10 mm. longum calloso-acutum acuminatis, margine anguste recurvatis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 6–9 erecto-patentibus utrinque leviter prominulis obscure anastomosantibus; floribus subterminalibus vel axillaribus solitariis vel 2 vel 3 aggregatis, bracteis papyraceis oblongo-ovatis caducis maximis 2–3 × 3–4 mm.; pedicellis inferne 1–1.5 mm. diametro superne valde incrassatis sub anthesi 10–23 (–35) mm. longis, interdum medium versus inconspicue 1-bracteolatis; segmentis perianthii 10–14 plerumque pellucido-glandulosis, exterioribus papyraceis obscure ciliolatis, interioribus tenuiter carnosis eciliatis, extimis late ovato-deltoideis 3.5–7 × 4.5–9 mm., maximis late ellipticis vel suborbicularibus 7–12 mm. longis latisque, intimis 1–4 obovatis 5–10 × 3.5–10 mm.; staminibus plerumque 2-seriatis 22–30 oblongis 1.8–3.4 mm. longis, filamentis carnosis ligulatis 1–2.4 mm. longis utrinque paullo angustatis, connectivo truncato vel leviter emarginato, thecis protuberantibus 0.7–1 mm. longis; carpellis sub anthesi 12–14, 2.5–4 mm. longis, ovario complanato-ellipsoideo 1.3–2.5 mm. longo, stylo subulato 1.1–2 mm. longo; pedicellis sub fructu ad 40 mm. longis, carpellis maturis (10–) 12–14 ovoideis, 13–20 mm.

longis, 6–9 mm. latis, 3–5 mm. crassis, in acuminem brevem angustatis; semine pallido-brunneo, 6–7 × 4–4.5 × 2–3 mm. FIG. 11, s–v.

TYPE LOCALITY: Hainan; *Lau 5438*, the best flowering specimen among those cited below, is designated as the type.

DISTRIBUTION: Hainan, at altitudes of 850–1700 m. See map, *fig. 12*. Habitats are noted as follows: forests, dense woods, wooded ravines, and forests along streams.

CHINA: HAINAN: Near "Fahuya" [Fa-hui], *W. Y. Chun 7122* (UC); Ng-chi-leng, Fan-yah, vicinity of Five Finger Mt., *N. K. Chun & C. L. Tso 44173* (A, K, NY, US); Five Finger Mt., *F. A. McClure 9501* (A) (fr. galled), *9535* (M) (fr. galled); Bak-sa, *S. K. Lau 26324* (A); Lok-tung, *S. K. Lau 27372* (A) (fr. imperfect); Dung-ka to Wen-fa-shi, *N. K. Chun & C. L. Tso 43783* (A, K, NY, US); Po-ting, *F. C. How 73567* (A); Chim-fung Mt., near Fong-ngau-po Village, Kan-en Hsien, *S. K. Lau 5438* (A TYPE), Feb. 1935; without locality, *C. Wang 35032* (A, NY), *H. Y. Liang 63398* (K, NY), *64185* (NY), *64197* (A, NY), *64844* (A, K, NY), *64845* (A, NY, US).

COLOR NOTES: The perianth-segments are variously recorded as red, bright red, or scarlet-red, and mature flowers have been collected from January to April. Fruits are said to be at first green, becoming brown-red; they mature between July and November.

SYNONYMY: The cited references to "*Illicium* sp." mention *McClure 9501* and *9535*, cited above, both atypical because of their galled fruits. Tanaka & Odashima merely list *I. Griffithii* from Hainan without citations, but they doubtless had material referable to my new species.

Although superficially this Hainan plant may be confused with *I. Griffithii* and *I. arborescens*, it is amply distinct on the basis of characters mentioned in my key to species.

28. **Illicium** (§ *Cymbostemon*) **cubense** sp. nov.

Illicium parviflorum sensu Griseb. in Mem. Acad. Am. Sci. Art. n. s. **8:** 154. 1860, Cat. Pl. Cub. 2. 1866; Sauvalle, Fl. Cub. 2. 1873; Gómez de la Maza, Distr. Gén. Fanerog. Cub. 20. 1895; non Michx. ex Vent.

Frutex vel arbor parva 2–5 m. alta, ramulis fuscis rugulosis subteretibus vel hornotinis leviter angulatis 1–2 mm. diametro, vetustioribus saepe cinereis ad 5 mm. diametro; foliis alternatis vel 3–5 ad nodos distales laxe aggregatis; petiolis gracilibus (0.7–1.5 mm. diametro) 7–20 mm. longis; laminis coriaceis vel subcoriaceis in sicco utrinque brunneis vel supra fusco-olivaceis, anguste oblongo-ellipticis vel obovato-ellipticis, (3–) 4–11 cm. longis, (1–) 1.5–4.5 cm. latis, basi attenuatis, apice rotundatis vel late obtusis vel leviter emarginatis, margine anguste recurvatis vel revolutis, costa supra peracute impressa subtus prominente, nervis secundariis utrinsecus 3–6 saepe obscuris erecto-patentibus supra immersis vel leviter prominulis vel obscure impressis subtus prominulis vel subplanis; floribus axillaribus vel subterminalibus solitariis vel 2 vel 3 aggregatis, bracteis basalibus paucis papyraceis late ovatis circiter 1 × 2 mm. caducis; pedicellis sub anthesi 6–10 mm. longis 1–1.5 mm. diametro bracteolas 1 vel 2 bracteis similes gerentibus; segmentis perianthii 15 vel 16 obscure glandulosis, exterioribus papyraceis ciliolatis, interioribus carnosis eciliatis, extimis 3 vel 4 valde reductis late ovato-deltoideis 1–1.5 × 2–3 mm., maximis ellipticis vel oblongo-obovatis 4.5–6.5 × 2.5–5.5 mm., intimis 4 vel 5 reductis 3.5–5.5 × 1.5–3.5 mm.; staminibus pro genere paucis 4 vel 5 uniseriatis oblongo-ellipsoideis 2.5–3.5 mm. longis, filamentis carnosis 1–1.7 mm. latis obscure glandulosis basi angustis, thecis introrsis subimmersis 0.9–1.2 mm. longis; carpellis 8 gracilibus sub anthesi 2–3 mm. longis, ovario in stylum gracilem subulatum 1–1.5 mm. longum attenuato; pedicellis sub fructu 10–24 mm. longis ad 2 mm. diametro, carpellis maturis 8 patulis, 7–13 mm. longis, 3.5–4.5 mm. latis, 1.5–4 mm. crassis, in acuminem brevem angustatis; semine stramineo vel pallide brunneo, maturitate ad 6 × 4 × 2.5 mm.

TYPE LOCALITY: Oriente, Cuba; *Shafer 9047*, the best flowering specimen available, is cited below as the type.

DISTRIBUTION: Oriente, Cuba, at altitudes from 450 to 1500 m., in thickets, pine woods, or at edge of woods. See map, *fig. 4*.

CUBA: ORIENTE: Loma del Gatu (part) and La Guinea (part), *C. Wright 3* (Ch, GH, M); road to "Pinal" from Mayari Abajo, *C. Wright 1844* (GH, M, NY, US); Sierra de Nipé, near Woodfred, *J. A. Shafer 3612* (GH, NY, US); San José, Sierra de Nipé, *R. A. Howard 6085* (GH), *6207* (GH); Gran Piedra, *J. A. Shafer 9047* (GH, NY TYPE, US), Mar. 4, 5, 1911.

LOCAL NAME and COLOR NOTES: *Anís* is recorded for the Cuban *Illicium* by Sauvalle and Gómez de la Maza. The perianth-segments and stamens are said to be red, but some collectors imply that the outer segments are yellowish or greenish. Seasonal development is not obvious, as flowering material has been obtained in January, March, August, and December. The fruits are probably yellowish and on most specimens available occur simultaneously with the flowers.

Illicium cubense has a remarkably similar homologue in Asia in the Hainan species *I. oligandrum*, but its true relationship is certainly with the other American species of § *Cymbostemon*, which are discussed above under *I. parviflorum*. This new species and *I. oligandrum*, which sometimes have only four stamens, represent the extreme of the genus in this respect.

29. **Illicium** (§ *Cymbostemon*) **oligandrum** Merr. & Chun in Sunyatsenia **5**: 57. *f. 3.* 1940.

Illicium cambodianum sensu Groff, Ding, & Groff in Lingn. Agr. Rev. **1** (2): 82. 1923; Merr. in Lingnan Sci. Jour. **5**: 75, 1927; Tanaka & Odashima in Jour. Soc. Trop. Agr. Taihoku **10**: 366. 1938; Masamune, Fl. Kainantensis 82. 1943; non Hance.

Illicium oliganthum Merr. & Chun ex Merr. in Jour. Arnold Arb. **19**: 28, nomen. 1938; Odashima & Tanaka in Jour. Soc. Trop. Agr. Taihoku **12**: 197, nomen. 1940; Masamune, Fl. Kainantensis 82, nomen. 1943.

Shrub or tree, up to 12 m. high, the branchlets rugulose, at first pale brown, slightly angled, and 1.5–2 mm. in diameter, the older ones cinereous, subterete, 3–4 mm. in diameter; leaves subopposite, in clusters of 3–5 at distal nodes; petioles 5–12 mm. long, 0.7–1.2 mm. in diameter; leaf-blades coriaceous, when dried green to dark green above and pale brown beneath, oblong-obovate or elliptic, 4–9 cm. long, 1.5–3.7 cm. broad, attenuate at base, obtusely short-cuspidate or rounded at apex, slightly recurved or narrowly revolute at margins, the costa nearly plane above or faintly impressed toward base, slightly raised beneath, the secondary nerves 4–6 per side, subspreading, obscure, immersed or faintly raised on both sides; flowers axillary or subterminal, solitary or paired, the subtending bracts few, papyraceous, broadly ovate, about 1.5 × 2 mm., soon caducous; pedicels stout (1–2.5 mm. in diameter), 9–15 mm. long at anthesis, sometimes inconspicuously unibracteolate near middle; perianth-segments 11–18, often obscurely glandular, the outer ones papyraceous, scariose-margined, pale-ciliolate, the inner ones thin-carnose and eciliate, the outermost 4–7 reniform to suborbicular, 1–5 × 2–6.5 mm., the largest ones elliptic or obovate-elliptic, 5–7 × 4.5–5.5 mm. (rarely up to 10 × 9 mm.), the innermost 1–7 reduced, 4.5–6.5 × 2–4 mm.; stamens 1-seriate, 4–7, oblong to obovate, 2.5–3.2 mm. long, the filaments thin-carnose, ligulate, 1.3–2 mm. long, narrowed at base, the connective truncate or faintly emarginate, the thecae introrse, strongly protuberant, 1–1.2 mm. long; carpels 8 (rarely 9), 2.5–3 mm. long at anthesis, the ovary triquetrous-ellipsoid, 1.3–1.5 mm. long, the style stout-subulate, equalling the ovary in length; mature fruits not seen.

TYPE LOCALITY: Hainan; type, *How 72901*, cited below.

DISTRIBUTION: Hainan, at altitudes of 700–1200 m., in mixed forest or woods or in dense thickets. See map, *fig. 10.*

CHINA: HAINAN: Po-ting District, Ta-ping Kong, Ta-chung, *F. C. How 72901* (A TYPE), June 14, 1935; Ting-on District, Five Finger Mt., *C. Wang 35490* (A, NY), *35509* (A, NY); Five Finger Mt., near summit, *F. A. McClure 9383* (Man); Ting-on District, Tung-gap, Mo-cheung Ling, *C. Wang 36015* (NY, US), *H. Y. Liang 64359* (A, NY, US); Lok-tung District, Cheong-on Village, Cheong-on Ling, *S. K. Lau 27307* (A) (fr. galled), *27315* (A).

COLOR NOTES: The flowers are said to be fragrant and to have greenish yellow perianth-segments (or the flower-buds are white to greenish white); specimens have been collected in full anthesis in May and June. No specimens with developed fruits are available.

SYNONYMY: Some of the references to *I. cambodianum* listed above cite specimens which are available to me. The binomial *I. oliganthum* has unfortunately been used several times, but it has no validity, having first been inadvertently mentioned in Merrill's discussion of *I. parvifolium*.

This remarkably distinct species is quite without close allies, although superficially it resembles the Indo-Chinese *I. parvifolium*.

30. **Illicium** (§ *Cymbostemon*) **kinabaluense** sp. nov.

Arbor parva (?), ramulis gracilibus subteretibus rugulosis, hornotinis brunneis 1–2 mm. diametro, vetustioribus cinereis ad 4 mm. diametro; foliis suboppositis vel 3–6 ad nodos distales laxe aggregatis; petiolis gracilibus (0.6–1.5 mm. diametro) 7–22 mm. longis; laminis coriaceis vel crasse coriaceis siccitate utrinque brunneis vel supra fusco-olivaceis, anguste ellipticis vel lanceolatis, (4–) 6–11 cm. longis, (1.2–) 1.8–4.5 (–5) cm. latis, basi attenuatis, in apicem 4–10 mm. longum acutum breviter acuminatis, margine anguste revolutis, costa supra plana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 4–7 saepe obscuris erecto-patentibus supra immersis vel utrinque minute prominulis; floribus axillaribus vel subterminalibus solitariis vel 2 vel 3 aggregatis, bracteis basalibus pluribus arcte imbricatis tenuiter coriaceis ovato-deltoideis circiter 2 × 3 mm.; pedicellis gracilibus sub anthesi 0.7–1.3 mm. diametro et 10–15 mm. longis; segmentis perianthii 10–15 obscure glandulosis, exterioribus submembranaceis vel papyraceis et minute ciliolatis, interioribus tenuiter carnosis eciliatis, extimis 2 suborbicularibus vel ellipticis 3.5–5 × 4–5 mm. maximis oblongo- vel obovato-ellipticis 7–9 × 4–5.5 mm., intimis 4–6 anguste ellipticis 6–8 × 3–4.5 mm.; staminibus plerumque 7 (interdum 5 vel 6?) 1-seriatis 2.5–4 mm. longis, filamentis subcarnosis complanatis 1.3–2.5 mm. longis basi angustis superne incrassatis, connectivo truncato vel minute apiculato, thecis protuberantibus 1–1.5 mm. longis; carpellis 8 sub anthesi 2.5–3.5 mm. longis, ovario 1.3–1.7 mm. longo in stylum conico-subulatum 1.2–2 mm. longum angustato; fructibus non visis.

TYPE LOCALITY: Mt. Kinabalu, Borneo; *Clemens 50154*, the best specimen available, is cited below as the type.

DISTRIBUTIÓN: Known only from the type locality, at altitudes of 1200–1500 m. (or perhaps with a greater range). Only the type has habitat-data, these being "wet jungle." See map, *fig. 9*.

BORNEO: BRITISH NORTH BORNEO: Mt. Kinabalu, *J. & M. S. Clemens 27111* (A), *29837* (A); Penibukan, near Pinokok Falls, Mt. Kinabalu, *J. & M. S. Clemens 40895* (A, UC); Penibukan, Mt. Kinabalu, *J. & M. S. Clemens 50154* (A TYPE), Nov. 3, 1933.

COLOR NOTES: The perianth-segments are red or "pink to red"; young buds are said to be purplish. Specimens taken in October and November have mature flowers, but no fruiting material is available.

Illicium kinabaluense is a remarkably distinct species, not closely allied to *I. cubense* and *I. oligandrum*, with which it is keyed because of its reduced number of stamens and carpels. However, it has no close relatives, being entirely distinct from the other two Bornean species, *I. cauliflorum* and *I. Stapfii*. It is noteworthy that the three species of *Illicium* thus far known from Borneo are not closely related to each other, and furthermore none of them has any close affinity with continental congeners.

31. **Illicium** (§ *Cymbostemon*) **Tsangii** sp. nov.

Illicium Henryi sensu Merr. in Lingnan Sci. Jour. **13**: 25. 1934; non Diels.

Frutex (?) 1.5–3 m. altus, ramulis subteretibus vel hornotinis leviter angulatis brunneis gracilibus (1–2.5 mm. diametro), annotinis saepe cinereis valde incras-

satis; squamis oblongo-lanceolatis 10–12 mm. longis fugacibus; foliis laxe alternatis vel suboppositis vel ad nodos distales 3 vel 4 aggregatis; petiolis 8–15 mm. longis 1–2.5 mm. diametro; laminis crasse coriaceis in sicco supra fusco-olivaceis vel fusco-viridibus subtus brunneis, lanceolatis vel anguste obovato-ellipticis, (5–) 6–13 cm. longis, (1.4–) 2–4.5 cm. latis, basi acutis vel attenuatis, in apicem 5–15 mm. longum plerumque calloso-acutum gradatim angustatis, margine recurvatis, costa supra peracute impressa subtus prominente, nervis secundariis utrinsecus 6–8 plerumque invisibilibus subpatentibus utrinque immersis vel obscure elevatis; floribus axillaribus vel subterminalibus solitariis vel binis, bracteis basalibus paucis papyraceis ovato-apiculatis circiter 1.5 × 2 mm. mox caducis; pedicellis crassis (1.2–2 mm. diametro) sub anthesi et sub fructu juvenili 14–32 mm. longis; segmentis perianthii 14–17 inconspicue glandulosis, exterioribus submembranaceis interdum leviter ciliolatis, interioribus papyraceis vel carnosis eciliatis, extimis late ovatis 2–4 × 3–4 mm., maximis oblongo-ellipticis 5–10 × 4–6 mm., intimis 7–10 oblongo-ellipticis vel lanceolatis 3–8 × 1–5 mm.; staminibus 7–10 uniseriatis 2.5–3.7 mm. longis, filamentis subcarnosis ligulatis 1.3–2 mm. longis, connectivo paullo emarginato, thecis protuberantibus 1.2–1.7 mm. longis; carpellis 7–10 erectis 3–5.5 mm. longis, ovario complanato-oblongo 1–1.7 mm. longo in stylum conspicuum gracilem subulatum 2–3.8 mm. longum attenuato; fructibus maturis non visis. FIG. 11, h–l.

TYPE LOCALITY: Tseng-ch'eng Hsien, Kwangtung; type, *Tsang 20397,* cited below.

DISTRIBUTION: Central Kwangtung, the altitude not stated, in habitats of "dry forest" or "swampy thickets." See map, *fig. 10.*

CHINA: KWANGTUNG: Ngok-shing Shan, Sai-lin-shan Village, Hsin-feng Hsien, *Y. W. Taam 546* (A); Sam-kok Shan, Cheung Uk Village [Chang-wu-ts'un], Ts'ung-hua Hsien, *W. T. Tsang 24941* (A); Naam-kwan [Nan-k'un] Shan, Tseng-ch'eng Hsien, *W. T. Tsang 20268* (A, K, M, NY), *20397* (A TYPE, K, NY), May 1, 1932.

LOCAL NAME and COLOR NOTES: The type is designated as *Ye-pat-kok-shue,* and is said to have yellow flowers; I believe the latter statement to refer to the outer perianth-segments only, as the other specimens are recorded as having red or purplish red flowers, which seems most likely from the dried appearance of the inner carnose perianth-segments. Taam records the local name as *Shan-bar-kok.*

SYNONYMY: The Tsang specimens from Naam-kwan Shan are cited in the listed reference to *I. Henryi.*

This striking species, although of the general relationship of *I. Henryi,* is unmistakably distinct, differing in its very thick and fleshy leaf-blades, its more numerous perianth-segments, and its fewer stamens with larger thecae. Like the other species of this immediate relationship, *I. Tsangii* has carpels with distinctly elongate styles.

32. **Illicium** (§ *Cymbostemon*) **Henryi** Diels in Bot. Jahrb. **29**: 323. 1900.

Shrub, up to 7 m. high, the branchlets rugulose, subterete or distally faintly angled, at first brownish and 2–3.5 mm. in diameter, at length cinereous and up to 5 mm. in diameter; leaves irregularly alternate below, loosely arranged in clusters of 2–5 at distal nodes; petioles 7–20 mm. long, 0.8–2 mm. in diameter; leaf-blades coriaceous, when dried usually dark green above and brownish beneath, lanceolate to oblanceolate or obovate-elliptic, 6–15 cm. long, 1.2–5 (–6) cm. broad, acute to attenuate at base, acuminate to cuspidate (rarely subobtuse) at apex (acumen usually 5–15 mm. long and callose-acute), narrowly recurved at margin, the costa subplane or shallowly impressed above, prominent beneath, the secondary nerves 5–8 per side, often obscure, ascending or erecto-patent, slightly raised or plane above, immersed or faintly raised beneath; flowers axillary or subterminal, solitary or aggregated in clusters of 2 or 3, the subtending bracts few, deltoid, about 1.5 × 2 mm. caducous; pedicels slender (0.8–1.5 mm. in diameter, slightly swollen distally), 10–46 mm. long at anthesis, ebracteolate; perianth-segments 10–14, sometimes obscurely glandular, the outer ones papyraceous or

submembranaceous, obscurely ciliolate, the outermost 3–6 ovate-deltoid or subreniform, 3–7 × 4–7 mm., the largest ones oblong-elliptic or broadly elliptic, 6–10 × 4–8.5 mm., the innermost 5–8 obovate to oblong-elliptic, 4–9 × 2.5–6 mm.; stamens 1–3-seriate, 11–28, 1.8–3.5 mm. long, the filaments thin-carnose, contracted at base and apex, 0.8–2.3 mm. long, the connective inconspicuous, truncate, the thecae strongly protuberant, 0.9–1.2 mm. long; carpels 7 or 8 (rarely to 10), 3.8–5 mm. long at anthesis, the ovary flattened-ovoid, 1.5–2 mm. long, the style conspicuous, subulate, 2.3–3.3 mm. long; fruiting pedicels 13–48 mm. long at maturity, the carpels usually 8 (sometimes 6 or 7), 12–20 mm. long, 5–8 mm. broad, 3–4 mm. thick, gradually narrowed to a conspicuous subulate acumen 3–5 mm. long; seed pale brown to stramineous, 6.5–7.5 × 5–5.5 × 2.5–3 mm.

TYPE LOCALITY: I-ch'ang, Hupeh; *Henry 3388* and *4156*, which may be considered cotype collections, are cited below under var. *typicum*. In the original publication Diels, without designating a type, cited these two Henry numbers and also three numbers collected in Szechuan by Bock & von Rosthorn. One of the latter numbers (*2326*) is available to me and I do not consider it varietally similar to the Henry numbers; it will be found cited under my second variety of the species. Because of his choice of a specific epithet, and because the details of his description best apply to them, Diels doubtless based his concept primarily upon the Henry collections.

DISTRIBUTION: Southern Shensi and eastern Szechuan to northern Kiangsi.

32a. **Illicium Henryi** var. **typicum** nom. nov.

Illicium Henryi Diels in Bot. Jahrb. **29:** 323. 1900; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 28, p. p. 1905 [repr. Contr. Fl. As. Or. **2:** 28. 1907]; Matsuda in Bot. Mag. Tokyo **21:** (243). 1907; Rehder & Wilson in Sargent, Pl. Wils. **1:** 417. 1913; Nakai in Bot. Mag. Tokyo **36:** 120. 1922.

Illicium Silvestrii Pavolini in Nuovo Giorn. Bot. Ital. **15:** 403. 1908, in Rep. Sp. Nov. **9:** 317. 1911.

Plant somewhat more robust than the following variety; petioles 7–20 mm. long and 1–2 mm. in diameter; leaf-blades (7–) 9–15 cm. long, (1.5–) 2–5 (–6) cm. broad; pedicels (10–) 15–46 mm. long at anthesis; largest perianth-segments 7–10 × 5–8.5 mm.; stamens 11–14, usually 1-seriate, 2.2–3.5 mm. long, the filaments 1.2–2.3 mm. long; carpels at anthesis 4–5 mm. long.

TYPE LOCALITY: I-ch'ang, Hupeh, as stated above under the species.

DISTRIBUTION: Southern Shensi to northern Kiangsi, most abundant in western Hupeh, at recorded elevations of 300 to 750 m. As habitats, forest, open hillsides, open valleys, and cliffs have been recorded. See map, *fig. 10*.

CHINA: SHENSI: Ta-pa Shan, near Han-chung, *G. Fenzel 591* (A). HUPEH: S. Wu-shan, *E. H. Wilson 603* (A, K, NY, US); I-ch'ang, *A. Henry 3388* (COTYPE COLL., A, GH, K), *3388C* (K), *4156* (COTYPE COLL., K, US), *E. H. Wilson 3087* in part (A, GH, K, US); I-ch'ang, "mountains up the river," *A. Henry 1165* (K); Nan-t'o and mountains to northward, *A. Henry 3848* (A, K, NY), *4500* (K); Hsing-shan Hsien, *E. H. Wilson 3086* (A, GH, K, US), *3086A* (A), *3087* in part (A); Pa-tung Hsien, *A. Henry 4084* (K), *H. C. Chow 118* (A, NY), *707* (A, NY); south of Pa-tung, *A. Henry 5547* (GH, K); "In-fon-ho," *G. C. Silvestri 732* (A, photo. and frag. of type of *I. Silvestrii*); western Hupeh without locality: *E. H. Wilson 431* (A, K, NY), *682* (A, K, NY), *W. Y. Chun 3793* (A); Hupeh without locality, *A. Henry 3388B* (US), *3388D* (GH). KIANGSI: Ku-ling, *W. Y. Chun 4283* (A); Yüan-shan Hsien, *H. H. Hu 1305* (A, K, Man, UC).

LOCAL NAME and COLOR NOTES: Wilson states that the local name near I-ch'ang is *Pa-k'ou-wei-shu*. The flowers have red to dark red or crimson perianth-segments and are mature in May and June; fruits mature from July to October and are generally said to be green.

SYNONYMY: Rehder & Wilson, in 1913, first reduced Pavolini's species to *I. Henryi*, a disposition which examination of a type photograph and fragment immediately verifies. The binomial *I. Henryi* has been very widely interpreted, but in my opinion its application in the limited sense should be restricted to the area mentioned above.

As at present interpreted by me, *I. Henryi* var. *typicum* is comparatively restricted in distribution. The Shensi specimen cited above is sterile, but it so

closely resembles typical material that it may be referred to this variety with considerable confidence. The cited specimens from Kiangsi, however, are placed here with question; both are in fruit and I can find no reason to exclude them from *I. Henryi*. The carpels are about 8 and the styles are characteristically long. In foliage they are also suggestive of *I. lanceolatum* and even of *I. verum*, being separable from the former by the few carpels and from the latter by the elongate styles. If these specimens are correctly placed, the ranges of *I. Henryi* and *I. lanceolatum* overlap in Kiangsi, and the former species is to be anticipated in adjacent Hunan. Further remarks on the relationships between these two species and *I. majus* will be found under the latter species.

The range of *I. Henryi* includes specimens from eastern Szechuan which I cannot separate specifically, although they appear to represent an entity worthy of varietal recognition. The two varieties of *I. Henryi* may be thus separated:

Stamens 11–14, 2.2–3.5 mm. long; carpels 4–5 mm. long at anthesis; pedicels at anthesis (10–) 15–46 mm. long ..... var. *typicum*.

Stamens (16–) 23–28, 1.8–2.8 mm. long; carpels 3.8–4 mm. long at anthesis; pedicels at anthesis 10–28 mm. long; leaf-blades averaging narrower than in var. *typicum*, 12–32 mm. broad ..... var. *multistamineum*.

32b. **Illicium Henryi** var. **multistamineum** var. nov.

Illicium Henryi sensu Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 28, p. p. 1905 [repr. Contr. Fl. As. Or. **2**: 28. 1907].

Planta a var. *typico* habitu paullo graciliore et staminibus pluribus differt; petiolis 7–12 mm. longis 0.8–1.5 mm. diametro; laminis lanceolatis vel oblanceolatis, 6–11 cm. longis, 1.2–3.2 cm. latis; pedicellis sub anthesi 10–28 mm. longis; segmentis perianthii maximis 6–8 × 4–6 mm.; staminibus 2- vel 3-seriatis, (16–) 23–28, 1.8–2.8 mm. longis, filamentis 0.8–1.6 mm. longis; carpellis sub anthesi 3.8–4 mm. longis.

Type locality: Ch'eng-k'ou, eastern Szechuan, type, *Farges 208 bis*, cited below.

Distribution: Eastern Szechuan. See map, *fig. 10*.

CHINA: Szechuan: "Tchen-kéou-tin" [Ch'eng-k'ou], *R. P. Farges 208 bis* (A, K, NY, type); Nan-ch'uan, *A. v. Rosthorn 2326* (A).

Synonymy: Finet & Gagnepain, in 1905, cited the Farges specimen among others as *I. Henryi*. In his original description Diels mentioned the above-cited von Rosthorn number, which, although lacking flowers, seems likely to belong in this variety.

The type of this variety is not to be confused with *Farges 208*, mentioned elsewhere (under *I. Simonsii*) as the type collection of *I. Fargesii* Finet & Gagnep.

33. **Illicium** (§ *Cymbostemon*) **pachyphyllum** sp. nov.

Frutex (?) ad 3 m. altus, ramulis subrugulosis cinereis vel fusco-cinereis subteretibus vel juventute leviter angulatis et 1.5–2.5 mm. diametro, vetustioribus ad 5 mm. diametro; squamis subcoriaceis oblongo-lanceolatis circiter 5 mm. longis fugacibus; foliis ad nodos distales 4–7 dense aggregatis; petiolis 3–12 mm. longis 1–2 mm. diametro; laminis coriaceis in sicco supra fusco-olivaceis subtus brunneis, lanceolatis vel oblanceolatis vel anguste ellipticis, (4–) 6–9 cm. longis, (1–) 1.5–3.3 cm. latis, basi attenuatis, in apicem calloso-acutum vel cuspidatum gradatim angustatis, margine anguste revolutis vel recurvatis, costa supra peracute impressa subtus elevata, nervis secundariis obscuris utrinsecus 6–9 subpatentibus supra planis subtus immersis; floribus axillaribus vel subterminalibus solitariis vel inter folia 2 vel 3 confertis, bracteis basalibus pluribus papyraceis late ovatis circiter 1.5 × 3 mm. mox caducis; pedicellis brevissimis sub anthesi et fructu juvenili 3–5 mm. longis 1.5–2 mm. diametro ebracteolatis; segmentis perianthii 9–12, exterioribus papyraceis et minute ciliolatis, interioribus carnosis et eciliatis, extimis 2–4 late ovatis vel oblongo-ellipticis 2.5–4 × 3–5 mm., maximis obovatis

vel oblongis 6–8.5 × 5–7 mm., intimis 4 vel 5 ellipticis vel obovatis 4–7 × 2–5 mm.; staminibus 13 vel 14 uniseriatis 2.2–2.6 mm. longis, filamentis carnosis 1.5–1.7 mm. longis utrinque angustatis superne valde incrassatis, connectivo conspicue carnoso truncato, thecis 0.8–0.9 mm. longis sublateralibus leviter protuberantibus; carpellis 8–10 sub anthesi 4–4.3 mm. longis, ovario triquetro-ellipsoideo 1.5–1.7 mm. longo, stylo subulato conspicuo 2.5–2.7 mm. longo superne gracillimo; pedicellis sub fructu ad 9 mm. longis, carpellis maturis 11–13 mm. longis, 6–7 mm. latis, 4–5 mm. crassis, in apicem fragilem abrupte angustatis.

TYPE LOCALITY: Near Shang-ssu, southern Kwangsi; type, *Tsang 24815*, cited below.

DISTRIBUTION: Limited to the vicinity of the type locality, or perhaps also represented from Kwangsi farther to the northeast. See map, *fig. 10*. Tsang notes the plant as "fairly common" in thickets; no altitude is stated.

CHINA: KWANGSI: Shap-man-taai Shan, Tang-lung Village, southeast of Shang-ssu, Kwangtung border, *W. T. Tsang 24278* (A, NY), *24425* (A, NY); same general locality, Nam-she Village, *W. T. Tsang 24815* (A TYPE, NY), Dec. 1–5, 1934; Yao Shan, Tseung-yüen, *? C. Wang 39499* (A).

LOCAL NAMES and COLOR NOTES: Each of the Tsang collections bears a local name, as follows: *Ching-pat-kok-shue* (no. *24278*), *Pat-kok-shue* (no. *24425*), and *Shan-pat-kok-shue* (no. *24815*). All are said to have fragrant flowers, but only the type has them at anthesis, in which condition they are said to be white. The other specimens have flower-buds (said to be purplish red) and fruits which are essentially mature in September and October. All the Tsang specimens state that the fruit is edible. The occurrence of *I. verum* in the same region may have inclined the residents to try other species of the genus.

Wang 39499, a specimen in young fruit, is doubtfully referred to this species, with which it agrees in its short pedicels, long styles, etc. Its foliage is not typical, the leaf-blades being thinner, more slenderly acuminate, and of a different color when dried. However, the Wang specimen suggests no other known species, and I suspect that, if *I. pachyphyllum* cannot be expanded to include it, it will prove to represent another novelty.

Illicium pachyphyllum is another one of the remarkably distinct *Illicia* discovered fairly recently by Chinese collectors in the southeastern mountains of their country, a region neglected by the earlier European explorers. It is amply differentiated from such allies as *I. Henryi* and *I. Tsangii* by its short pedicels and by various obvious foliage and floral characters. A key to the species of this region will be found under *I. Dunnianum*, below.

34. **Illicium** (§ *Cymbostemon*) **Stapfii** Merr. in Philip. Jour. Sci. Bot. **13**: 67. 1918, Bibl. Enum. Born. Pl. 252. 1921.

Illicium sp. Stapf in Trans. Linn. Soc. II. Bot. **4**: 128. 1894; Ridley in Sarawak Mus. Jour. **1** (3): 71. 1913.

Tree, up to 8 m. high, the branchlets robust, rugulose, subterete, cinereous or brownish, distally 3–5 mm. in diameter; leaves subopposite or aggregated in clusters of 3–5 at distal nodes; petioles stout (2–4 mm. in diameter), deeply canaliculate, 10–20 mm. long; leaf-blades coriaceous or thick-coriaceous, when dried usually dark olivaceous above and brownish beneath, broadly elliptic or slightly obovate-elliptic, 11–17 cm. long, (4–) 5–9 cm. broad, obtuse at base, cuspidate at apex (acumen 5–10 mm. long and callose-acute or obtuse), narrowly revolute at margins, the costa impressed above, very prominent and rugulose beneath, the secondary nerves 6–11 per side, spreading, slightly raised or subplane above, sharply prominulous and clearly anastomosing beneath, the tertiary nerves sometimes prominulous beneath; flowers axillary or subterminal, solitary, rarely persisting on branchlets below apical leaves or possibly on the trunk, the subtending bracts fugacious; pedicels slender, 1–1.5 mm. in diameter, enlarged distally, 20–35 mm. long at anthesis, ebracteolate; perianth-segments 12–15, all essentially similar, papyraceous to thin-carnose, densely but inconspicuously pellucid-glandular,

oblong- to obovate-elliptic, the 2 or 3 outermost ones 7–9 × 5–6 mm., pale-ciliolate, the largest ones 9–12 × 5–7 mm., eciliate, the innermost 3 or 4 slightly narrower, 7–10 × 3–5 mm.; stamens 12 or 13, uniseriate, 3.5–4 mm. long, the filaments thin-carnose, flattened, narrowed at base, enlarged upward, 1.8–2.3 mm. long, the connective broad, truncate or slightly emarginate, the thecae introrse, protuberant, 1.5–1.8 mm. long; toral appendage conspicuous, clavate, 1–1.4 mm. long; carpels 8–10, 4–5 mm. long at anthesis, the ovary triquetrous-ellipsoid, 1.7–2.4 mm. long, the style very slender, subulate, 2.2–3 mm. long; fruiting pedicels elongated, up to 80 mm. long, the carpels usually 8 or 9, spreading, 12–16 mm. long, 6–7 mm. broad, 3–4 mm. thick, gradually attenuate into a subulate acumen 2–3 mm. long; seed pale brown, about 6–7 × 4.5 × 3 mm.

TYPE LOCALITY: Mt. Kinabalu, British North Borneo; in the original description Merrill mentions *Clemens 10949, 10995,* and *11081,* specimens deposited in the Bureau of Science herbarium, Manila. Fortunately two of these were in this country on loan at the time of the destruction of the Manila collection, and they are cited below as cotypes. Although Merrill remarked the resemblance of his material to Stapf's diagnosis (without specific name, based on *Haviland 1272,* cited below), he did not see the Haviland specimen and therefore there can be no question of considering this the type.

DISTRIBUTION: Known only from Mt. Kinabalu, at recorded altitudes of 1200–1500 m., presumably in forest and often along ridges. See map, *fig. 9.*

BORNEO: BRITISH NORTH BORNEO: Mt. Kinabalu, Marai Parai Spur, *M. S. Clemens 10949* (Man COTYPE), *10995* (Man COTYPE); Mt. Kinabalu, W. Marai Parai, *J. & M. S. Clemens 35039* (A, UC); Mt. Kinabalu, Kinitaki, *G. D. Haviland 1272* (K); Mt. Kinabalu, Penibukan, ridge toward Kinitaki, *J. & M. S. Clemens 31673* (A, UC); Mt. Kinabalu, Penibukan, ridge above camp, *J. & M. S. Clemens,* Jan. 18, 1933 (A, UC); Mt. Kinabalu, Columbon basin, *J. & M. S. Clemens 35060* (A), *40084* (A, UC).

COLOR NOTES: The flowers have red or dull red perianth-segments and are found at anthesis in December and January; throughout much of the rest of the year red flower-buds are available. Partly mature fruits accompany nos. *10995* (December) and *35060* (August).

As mentioned above under *I. kinabaluense,* the three Bornean *Illicia* are only remotely related to each other. *Illicium Stapfii* is one of the most distinct species of the genus, at once characterized by its large coriaceous leaf-blades and its unreduced outer perianth-segments; in fundamental characters it doubtless belongs in the group of *I. Henryi,* but its relationship to any continental species is probably distant.

35. **Illicium** (§ *Cymbostemon*) **Ridleyanum** sp. nov.

Illicium cambodianum sensu King in Jour. As. Soc. Beng. **58** (2): 374, p. p. 1889, in Ann. Bot. Gard. Calcutta **3**: 200, p. p. 1891; Ridley, Fl. Malay Penins. **1**: 18, p. p. *f. 4* (fl.). 1922; non Hance.

Illicium cambodianum var. *crassifolia* (sic) Ridley, Fl. Malay Penins. **1**: 19, p. p. 1922.

Arbor ad 7 m. alta (vel ultra?), ramulis gracilibus subteretibus rugulosis nodis paullo incrassatis, juventute fusco-cinereis 1–2 mm. diametro; squamis tenuiter coriaceis suborbiculari-ovatis ad 3 mm. longis fugacibus; foliis suboppositis et ad nodos distales 3 vel 4 aggregatis; petiolis 7–20 mm. longis 0.8–1.5 mm. diametro; laminis coriaceis siccitate utrinque fusco-olivaceis, ellipticis, (4–) 5–10 cm. longis, (1.5–) 2.5–4.5 cm. latis, basi acutis et in petiolum evidenter decurrentibus, apicem calloso-acutum cuspidatis vel breviter acuminatis, margine anguste recurvatis, costa supra subplana vel leviter impressa subtus prominente nervis secundariis utrinsecus 5–8 subpatentibus utrinque leviter elevatis vel subtus haud prominulis; floribus axillaribus vel subterminalibus solitariis, bracteis basalibus papyraceis late ovato-deltoideis ad 2 × 3 mm.; pedicellis sub anthesi 3–17 mm. longis 0.8–1.6 mm. diametro interdum basim versus 1-bracteolatis; segmentis perianthii 8–13 magnitudine omnino subaequalibus, extimis 2 papyraceis elliptico-oblongis saepe conspicue glandulosis ciliolatis plerumque 7–9 × 5–8 mm. (raro minoribus), maximis subcarnosis vel submembranaceis suborbicularibus vel late ellipticis ob-

scure ciliolatis 9–9.5 × 6–8 mm., interioribus similibus eciliatis, intimis 2–5 paullo minoribus 5–9 × 2.5–4 mm.; staminibus 10–14 uniseriatis 3.5–4.2 mm. longis, filamentis carnosis ligulatis 2–2.8 mm. longis, antheris oblongis 1–1.7 longis, connectivo truncato; carpellis sub anthesi (5–) 7–9, 4.5–5 mm. longis, ovario complanato-ellipsoideo circiter 2 mm. longo, stylo gracili subulato 2.5–3 mm. longo; pedicellis sub fructu haud elongatis, carpellis maturis 11–12 mm. longis, 4–5 mm. latis, 3–4 mm. crassis, in acuminem ad 3 mm. longum gradatim attenuatis; semine pallide brunneo 5–5.5 × 4 × 2.5–3 mm.

TYPE LOCALITY: Selangor, Malay Peninsula; type, *Robinson*, cited below.

DISTRIBUTION: Malay Peninsula, in mountain forests at 1200–1500 m. altitude. See map, *fig. 9.*

MALAY PENINSULA: PERAK: Gunong Batu Puteh, *L. Wray 251* (K); without locality, *B. Scortechini* in part (K). PAHANG: K'luang Terbang, *W. D. Barnes 10876* (K); Fraser Hill, Selangor border, *I. H. Burkill & R. E. Holttum 8583* (K); Ulu Sg Ikan, Ulu Telom, *Forest Dept.* (coll. *Ja'amat*) *27635* (K); Gunong Berembun, *H. N. Ridley 13563* (K). SELANGOR: Gunong Mengkuang, *H. C. Robinson*, Jan. 18, 1913 (K TYPE). STATE?: Cameron Highlands, *H. C. Dolman 25933* (K).

COLOR NOTES: The perianth-segments are usually noted as red, but the outer ones may be somewhat paler, perhaps pinkish. Flowers at anthesis have been collected in August, November, and January. The only specimen with mature fruits (*Burkill & Holttum 8583*), collected in September, also bore flowers.

The confusion surrounding the identity of the species of *Illicium* occurring in the Malay Peninsula has been discussed above under *I. peninsulare*, where a key to the three species here recognized is given. It seems unlikely that any student carefully examining the material cited under these three species, at least if good flowers were available for dissection, would be inclined to group them in a single entity. *Illicium Ridleyanum* is excellently marked, not only by its comparatively small and uniformly elliptic leaf-blades, but especially by its unreduced outer perianth-segments, and also by other details of perianth and stamens mentioned in my keys.

36. **Illicium** (§ *Cymbostemon*) **Merrillianum** sp. nov.

Illicium cambodianum sensu Merr. in Brittonia **4**: 53. 1941: non Hance.

Arbor parva, ramulis gracilibus subteretibus rugulosis, hornotinis brunnescentibus 1.5–2 mm. diametro, vetustioribus cinereis ad 3.5 mm. diametro; squamis subcoriaceis lanceolatis 5–7 mm. longis fugacibus; foliis suboppositis vel ad nodos distales 3–5 aggregatis; petiolis 6–15 mm. longis 1–2 mm. diametro; laminis coriaceis siccitate supra fusco-olivaceis vel utrinque brunneis, ellipticis vel lanceolatis, (6–) 8–12.5 cm. longis, (1.5–) 2–5 cm. latis, basi acutis, in apicem 5–15 mm. longum calloso-acutum acuminatis, margine anguste revolutis, costa supra peracute impressa subtus prominente, nervis secundariis utrinsecus 6–11 erecto-patentibus utrinque prominulis vel subplanis obvie anastomosantibus; floribus axillaribus vel subterminalibus solitariis vel 2 vel 3 aggregatis, bracteis basalibus pluribus papyraceis oblongis maximis 4 × 3 mm.; pedicellis gracilibus (0.8–1.5 mm. diametro, superne paullo incrassatis) sub anthesi 20–40 mm. longis interdum medium versus obscure bracteolatis; segmentis perianthii 15–20 inconspicue glanduloso-punctatis, exterioribus papyraceis vel membranaceis minute ciliolatis, interioribus carnosis eciliatis, extimis 2–7 suborbicularibus vel deltoideis 3–6.5 × 3–7.5 mm., maximis ellipticis 7–10 × 5–7.5 mm., intimis 8 vel 9 ellipticis vel oblongis, minimis ad 6–7 × 3–3.5 mm. reductis; staminibus 1- vel 2-seriatis 14–18, 2.5–4 mm. longis, filamentis subcarnosis ligulatis 1.5–2.7 mm. longis, connectivo inconspicuo truncato, thecis protuberantibus 1–1.3 mm. longis; carpellis 8 sub anthesi 3.5–4.5 mm. longis, ovario triquetro-ovoideo 1.5–2.2 mm. longo in stylum conico-subulatum 1.8–2.5 mm. longum angustatis; fructibus maturis non visis.

TYPE LOCALITY: Northern Burma, without exact locality; type, *Ward 10193*, cited below.

DISTRIBUTION: Northern Burma and adjacent Yünnan; unfortunately three of the four cited specimens are lacking detailed locality data. The two Ward specimens were obtained in hill forest at 1500–1800 m. altitude. See map, *fig. 13* (which gives the locality of *Ward 9095* only).

CHINA: YÜNNAN: Without locality, *G. Forrest 11895* (A, K), *17695* (A, K).

BURMA: SAGAING: Myitkyina: Mills east of the Nam Tisang (River), *F. K. Ward 9095* (A); [Myitkyina?]: Without locality, *F. K. Ward 10193* (A TYPE) (excl. fruit), Dec. 3, 1931.

COLOR NOTES: The Ward specimens bear flowers, mature in December and without perianth in January, of which the perianth-segments are said to be cherry-red.

SYNONYMY: Merrill's identification of the Ward collections as *I. cambodianum* was doubtless influenced by the fact that no. *10193* is accompanied by mature fruits which are 12-carpellate. These were probably taken from the ground and not from the same tree as the foliage and flowers; in my opinion they represent another species of *Illicium*.

Illicium Merrillianum suggests no other species known from the Burma-Yünnan region, and there seems no alternative but to recognize the cited specimens as representing a rather distinct novelty. Its relationship to such species of the same general region as *I. micranthum*, *I. Griffithii*, and *I. modestum* seems quite remote, but nevertheless these are perhaps in the same line of descent. Certain differences between the cited Burmese specimens and those from Yünnan, in foliage and perianth, are discernible, but I believe the entity as described to be reasonably coherent.

37. **Illicium** (§ *Cymbostemon*) **tenuifolium** (Ridley) comb. nov.

Illicium cambodianum sensu King in Jour. As. Soc. Beng. **58** (*2*): 374, p. p. 1889, in Ann. Bot. Gard. Calcutta **3**: 200, p. p. 1891; non Hance.

Illicium cambodianum var. *tenuifolia* (sic) Ridley, Fl. Malay Penins. **1**: 18, quoad part. lectotyp. 1922.

Small tree, perhaps not exceeding 7 m. in height, the branchlets slender, subterete, faintly rugulose, cinereous or pale brown when young and 1–2.5 mm. in diameter; bud-scales papyraceous, oblong, up to 2 mm. long, fugacious; leaves subopposite or in clusters of 3–5 at distal nodes; petioles 5–18 mm. long, 0.8–2 mm. in diameter; leaf-blades papyraceous or chartaceous, sometimes subcoriaceous when older, when dried dark green or dark olivaceous on both sides, elliptic to lanceolate or obovate, (6–) 8–19 cm. long, (2–) 3–6.5 (–7) cm. broad, obtuse to attenuate at base, cuspidate to long-acuminate at apex (actual apex callose-acute), plane or inconspicuously recurved at margin, the costa slightly impressed above and prominent beneath, the secondary nerves 5–10 per side, subspreading, slightly raised or prominulous on both sides; flowers axillary or subterminal and solitary, or glomerulate on trunk or branches, the subtending bracts several papyraceous, deltoid, up to 1 × 2 mm., fugacious; pedicels terete, faintly rugulose, very slender (0.4–1 mm. in diameter), 9–50 mm. long at anthesis, sometimes minutely 1-bracteolate near middle or toward base (bracteole about 1 × 1 mm.); perianth-segments 11–18, the outer ones papyraceous or membranaceous, faintly ciliolate, the inner ones carnose and eciliate, the outermost 2–4 ovate-deltoid, 1–2.5 × 1.5–3 mm., the next few transitional, the largest ones suborbicular, 4–7.5 × 4–8 mm., the innermost 4–7 elliptic-oblong to lanceolate, 3–6 × 1.5–5 mm.; stamens usually 1-seriate, 11–16, 2–3.2 mm. long, the filaments thin-carnose, ligulate, 1–1.8 mm. long, the connective truncate or faintly emarginate, the thecae 0.8–1.4 mm. long; carpels usually 8 (sometimes 5–8), 2.5–4 mm. long at anthesis, the ovary triquetrous, 1–1.7 mm. long, the style slender, subulate 1.5–2.8 mm. long; fruiting pedicels not noticeably elongating, the carpels usually 8, slightly before maturity 10–12 mm. long, 4–6 mm. broad, 2.5–3 mm. thick, terminating in a slender acumen 3–5 mm. long; seed pale brown, about 6 × 4 × 2.5 mm.

TYPE LOCALITY: Pahang, Malay Peninsula; lectotype, *Ridley 13534*, discussed below.

DISTRIBUTION: Malay Peninsula, at recorded elevations of 300–1400 m., presumably in hill forest. See map, *fig. 9*. The sparse available data do not indicate any altitudinal or habitat variation for the three varieties.

LOCAL NAME and COLOR NOTES: The only local name recorded is *Jankaroh* (mentioned by Dolman for var. *obovatum*). The flowers are apparently pale green to waxy white when young, but mature perianth-segments, at least in var. *tenuifolium*, are said to be dark red or claret-colored, presumably paler toward the base. There are not sufficient data at hand accurately to indicate the dates of flowering and fruiting, but these are apparently highly variable.

Ridley's var. *"tenuifolia"* of *I. cambodianum* seems to me to include the elements of at least two varieties, as indicated by the specimens he cites. The brief description seems best to agree with the first three specimens cited, especially with *Ridley 13534* from Telom Cascade, Pahang (locality only cited by Ridley), and *Kloss* (Feb. 1912) from Menuang Gasing, Selangor. The Ridley specimen from Gunong Tahan (probably no. *16089*) is not entirely typical, having thicker than average leaves. However, I take these three specimens, in addition to several others cited below by me, to be representative of Ridley's variety, and in order to avoid future ambiguity I designate *Ridley 13534* as the lectotype of *I. cambodianum* var. *"tenuifolia."* This specimen thus becomes the type of my *I. tenuifolium* and its typical variety, var. *tenuifolium*.

Illicium tenuifolium, as characterized by the above emended description, is very clearly distinct from the other two species occurring in the Malay Peninsula, *I. peninsulare* and *I. Ridleyanum*. However, it seems more variable than either of those species, and for the present I believe it to be divisible into three varieties. These varieties are not sharply separable, and it is probable that intermediate forms will be found. Characters pertaining to leaf-shape and position of flowers make possible the recognition of the varieties as stated in the following key. It seems likely that future workers will modify this treatment, when more ample material from the Malay Peninsula is available.

Flowers and fruits axillary; leaf-blades elliptic, 2–2.5 (–3) times as long as broad, gradually or somewhat abruptly acuminate at apex; pedicels 25–48 mm. long at anthesis and in fruit; perianth-segments 16–18, the largest ones 5.5–7.5 mm. long; stamens 13–16. var. *tenuifolium*.

Flowers axillary; leaf-blades lanceolate, 3–4 times as long as broad, long-acuminate at apex; pedicels 15–50 mm. long at anthesis; perianth-segments 14 or 15, the largest ones 4.5–5 mm. long; stamens about 12 ..... var. *angustifolium*.

Flowers arising from complex glomerules on trunk or branches; leaf-blades elliptic- or lanceolate-obovate, 2–3.5 times as long as broad, abruptly cuspidate or acuminate at apex; pedicels 9–23 mm. long at anthesis; perianth-segments 11–15, the largest ones 4–7 mm. long; stamens 11–16 ..... var. *obovatum*.

37a. **Illicium tenuifolium** var. **tenuifolium** (Ridley) comb. nov.

Illicium cambodianum var. *tenuifolia* (sic) Ridley, Fl. Malay Penins. 1: 18, quoad part. lectotyp. 1922.

Illicium cambodianum var. *crassifolia* (sic) Ridley, Fl. Malay Penins. 1: 19, p. p. 1922.

Leaf-blades elliptic or narrowly elliptic, (6–) 8–14 cm. long, (2–) 3–6.5 cm. broad, obtuse or acute at base, gradually or somewhat abruptly acuminate at apex; flowers axillary or subterminal; pedicels 25–48 mm. long at anthesis; perianth-segments 16–18, the largest ones 5.5–7.5 × 5–6 mm.; stamens 13–16.

MALAY PENINSULA: KEDAH: Kedah Peak, *H. C. Robinson & C. B. Kloss 6003* (K). PERAK: Larut Hills, *G. King's collector 3816* (K), *6980* (K); Gunong Kerbau, *M. Haniff 4017* (K); Gunong Hijau, *I. H. Burkill & M. Haniff 12657* (A); Buch's Hill, *I. H. Burkill & M. Haniff 12855* (UC); without locality: *B. Scortechini* in part (US). PEHANG: Telom Cascade, *H. N. Ridley 13534* (K LECTOTYPE), Nov. 1908; Gunong Tahan,

H. N. Ridley 16089 (K), *16268* (K). SELANGOR: Menuang Gasing, *C. B. Kloss*, Feb. 1912 (K). NEGRI SEMBILAN: Gunong Angsi, *M. Nur 11762* (A, UC).

37b. **Illicium tenuifolium** var. **angustifolium** var. nov.

Illicium cambodianum sensu Ridley, Fl. Malay Penins. 1: 18, p. p. *f. 4* (fol.). 1922; non Hance.

Illicium cambodianum var. *crassifolia* (sic) Ridley, Fl. Malay Penins. 1: 19, p. p. 1922.

Planta a var. *tenuifolio* laminis lanceolatis, segmentis perianthii paucioribus minoribusque, staminibus paucioribus differt; laminis (6–) 10–19 cm. longis, (2–) 3–4.5 (–7) cm. latis, basi attenuatis, apice longe acuminatis; floribus axillaribus vel subterminalibus; pedicellis sub anthesi 15–50 mm. longis; segmentis perianthii 14 vel 15, maximis 4–5 × 3.5–5 mm.; staminibus circiter 12.

TYPE LOCALITY: Kedah, Malay Peninsula; type, *Robinson & Kloss 6089*.

MALAY PENINSULA: KEDAH: Kedah Peak, *H. C. Robinson & C. B. Kloss 6089* (K TYPE), Dec. 5, 1915. PERAK: Gunong Batu Puteh, *L. Wray 1029* (K, US); without locality, *B. Scortechini* in part (K). PAHANG: Raub, *Forest Dept. 22539* (K).

37c. **Illicium tenuifolium** var. **obovatum** var. nov.

Illicium cambodianum var. *tenuifolia* (sic) Ridley Fl. Malay Penins. 1: 18, p. p. 1922.

Planta a varietatibus aliis laminis obovatis, habitu caulifloro, pedicellis brevioribus differt; laminis elliptico- vel lanceolato-obovatis, 8–14 cm. longis, 3–6 cm. latis, basi acutis vel attenuatis, apice abrupte cuspidatis vel acuminatis; floribus in glomerulis saepe intricatis e trunco vel ramis orientibus; pedicellis sub anthesi 9–23 mm. longis; segmentis perianthii 11–15, maximis 4–7 × 4–8 mm.; staminibus 11–16.

TYPE LOCALITY: Selangor, Malay Peninsula; type, *Symington 24243*.

MALAY PENINSULA: KEDAH: Kedah Peak, *L. M. Bell & M. Haniff*, Mar. 1911 (K). SELANGOR: Bukit Payong Kajang, *C. F. Symington 24243* (K TYPE), Apr. 22, 1930. STATE?: Gurah Pass, *H. C. Dolman 27604* (K).

38. **Illicium** (§ *Cymbostemon*) **sumatranum** sp. nov.

Arbor (?), ramulis gracilibus subteretibus, juventute fuscis 1.5–2 mm. diametro, vetustioribus cinereis ad 3 mm. diametro; foliis ad nodos distales 3 vel 4 verticillatis; petiolis 4–7 mm. longis 1–1.5 mm. diametro; laminis coriaceis in sicco utrinque fuscis, oblongo-ellipticis, 6–8.5 cm. longis, 2–3.3 cm. latis, basi obtusis, in apicem 5–10 mm. longum calloso-acutum gradatim attenuatis, margine valde recurvatis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 6–9 subpatentibus anastomosantibus utrinque minute prominulis vel subtus immersis; floribus ut videtur axillaribus solitariisque, bracteis basalibus paucis minutis; pedicellis gracillibus circiter 1 mm. diametro superne paullo incrassatis sub anthesi et sub fructu circiter 20 mm. longis ut videtur ebracteolatis; segmentis perianthii 18 vel 19 obscure glandulosis, exterioribus papyraceis vel coriaceis obscure ciliolatis, interioribus carnosis eciliatis extimis 4 ovato-deltoideis 1.5–2 × 2–3 mm., maximis suborbicularibus 5–7 mm. longis latisque, intimis 9 vel 10 incrassatis anguste ellipticis, minimis 5–6 × 1.5–4 mm. saepe medium versus intus longitudinaliter costatis; staminibus 1- vel 2-seriatis 15 anguste oblongis 3.3–3.7 mm. longis, filamentis crasse carnosis 1.5–2 mm. longis superne subteretibus, connectivo truncato vel obtuso apicem versus obscure papilloso, thecis leviter protuberantibus 1.4–1.8 mm. longis; carpellis 7 vel 8 sub anthesi 3.7–4 mm. longis, ovario triquetro-ovoideo 1.2–1.5 mm. longo, stylo gracillimo subulato 2.5–2.8 mm. longo; carpellis maturis interdum abortu paucis, 12–14 mm. longis, 5–6 mm. latis, 3.5–4 mm. crassis, in apicem 2–3 mm. longum abrupte cuspidatis; semine stramineo circiter 5 × 4 × 2.5 mm.

TYPE LOCALITY: Atjeh, Sumatra; type, *van Steenis 6317*.

DISTRIBUTION: Known only from the type collection, obtained at 1800 m. altitude. See map, *fig. 9*.

SUMATRA: ATJEH: Boer ni Lintang, *C. G. G. J. van Steenis 6317* (A TYPE, K), in 1934.

The cited specimen, the only representative of the genus in Sumatra thus far known to me, is closely related only to the preceding *I. tenuifolium,* from the Malay Peninsula. I believe the Sumatran plant to be specifically distinct, however, on the basis of its larger stamens with thicker filaments and longer thecae, as well as because of certain characteristics of foliage which are apparent upon direct comparison.

39. **Illicium** (§ *Cymbostemon*) **Dunnianum** Tutcher in Jour. Linn. Soc. Bot. **37**: 62. 1905; Matsuda in Bot. Mag. Tokyo **21**: (244). 1907; Dunn & Tutcher in Kew Bull. Add. Ser. **10**: 28. 1912; Herklots in Hong Kong Nat. **4**: 20. *pl. 5; f. 1.* 1933.

? Ilicium (sic) *micranthum* sensu H. Lév. Fl. Kouy-Tchéou 269. 1914; non Dunn.

Shrub, usually less than 3 m. high (or small tree up to 10 m. high), the branchlets slender, rugulose, the younger ones brownish, subterete or lightly angled, 1.5–3 mm. in diameter, the older ones often cinereous and up to 6 mm. in diameter; bud-scales thin-coriaceous, lanceolate-elliptic, the largest ones about 8 mm. long; leaves crowded toward apices of branchlets, pseudoverticillate at distal nodes in clusters of 3–8; petioles narrowly winged distally, 3–12 mm. long, 1–2 mm. in diameter; leaf-blades thin-coriaceous, when dried usually brown on both sides or dark olivaceous above, lanceolate or oblanceolate, (5–) 6–12 cm. long, (0.8–) 1.2–2.7 cm. broad, attenuate at base, gradually acuminate or attenuate to a callose-acute apex, recurved or narrowly revolute at margin, the costa slightly impressed above, prominent beneath, the secondary nerves 5–9 per side, short, often obscure, ascending, prominulous or immersed on both sides, irregularly anastomosing; flowers axillary or subterminal, solitary or in clusters of 2 or 3 among leaves at distal nodes, the subtending bracts several, papyraceous, oblong, up to 3 × 4 mm.; pedicels slender (0.5–1 mm. in diameter, slightly swollen distally), rugulose, (5–) 10–35 mm. long at anthesis, ebracteolate or with a single orbicular-ovate bracteole about 2.5 × 2 mm. near middle; perianth-segments 12–20, obscurely punctate, the outer ones papyraceous and ciliolate, the inner ones papyraceous to subcoriaceous or thin-carnose, eciliate, the outermost few (1–5) suborbicular-reniform or broadly deltoid, 2.5–6 × 3–7 mm., the largest ones elliptic to suborbicular, 6–9 × 4–8 mm., the innermost few oblong to broadly obovate, 4–7.5 × 2–8 mm.; stamens 19–31 (very rarely as few as 10), usually 2- or 3-seriate, oblong, 1.7–3.3 mm. long, the filaments carnose, ligulate or narrowed toward base, 0.7–1.8 mm. long, the connective obtuse to slightly emarginate, the thecae slightly protuberant, 0.8–1.5 mm. long; carpels 8–13, at anthesis 2.5–3.5 mm. long, the ovary flattened-ellipsoid, 1.2–1.5 mm. long, narrowed into a subulate style 1.4–2 mm. long; fruiting pedicel 20–55 mm. long at maturity, slender, the carpels 8–13, at full maturity 9–15 mm. long, about 4 mm. broad, 2–3 mm. thick, gradually narrowed into a subulate acumen usually 3–5 mm. long; seed stramineous, comparatively small, 4–5 × 2.5–3.3 × 1.7–2.2 mm.

TYPE LOCALITY: Kowloon, Hongkong; type, *Herb. Hongk. 966,* cited below.

DISTRIBUTION: Southeastern China, in Hongkong, Kwangtung, Kwangsi and southern Kweichow, at recorded elevations of 600–750 m. (but probably more variable). See map, *fig. 13.* Recorded habitats include mixed woods, dense woods, thickets, moist mountain-side, and along streams in wooded ravines.

CHINA: KWEICHOW: Tu-yün, *Y. Tsiang 5919* (NY); P'ing-fa, *J. Cavalerie 1014* (K); Chen-feng, *Y. Tsiang 4219* (NY); Pai-ts'eng, *J. Cavalerie 4491* (K); Huang-ts'ao-pa, *J. Cavalerie 4484* (K). HONGKONG: Sam-tam-lo, Kowloon, New Territory, *Herb. Hongk. 966* (K TYPE), Mar. 7, 1903; U-kan-tin, New Territory, *W. J. Tutcher* (Herb. Hongk.) *10911* (K, Man). KWANGTUNG: Sha-lo Shan, Lo-lo-ha Village, Hsin-feng Hsien, *Y. W. Taam 982* (A); Sam-kok Shan, Cheung-uk Village [Chang-wu-ts'un], Ts'ung-hua Hsien, *W. T. Tsang 24898* (A); Naam-kwan [Nan-k'un] Shan, Tseng-ch'eng Hsien, *W. T. Tsang*

20129 (A, K, M, NY, UC, US); Lin-fa Shan, Lin-fung Monastery, Hui-yang Hsien, *W. T. Tsang 25476* (A), *25703* (A); "Tai Young Mt.," *F. A. McClure 471* (C. C. C. 7228) (NY). KWANGSI: Seh-feng-dar Shan, S. Nan-ning, *R. C. Ching 8140* (NY); Shap-man-taai Shan, near Ping-hoh Village, southeast of Shang-ssu, Kwangtung border, *W. T. Tsang 22042* (A).

LOCAL NAMES and COLOR NOTES: Taam records the name *Shan-bar-kok*, while Tsang lists *Hung-fa-hoh-shue*, *Ye-pat-kok-shue*, and *Shan-pat-kok-shue*. The two last names, in this or essentially similar form, are also recorded by Tsang for *I. Tsangii* and *I. pachyphyllum*, and the same collector states that the fruits of both *I. Dunnianum* and *I. pachyphyllum* are edible. This would indicate that, in those regions of Kwangtung and Kwangsi explored by Tsang, the local names and the use are common to several, or perhaps all, species of *Illicium*.

The perianth-segments are purple or purplish red, and flowers seem to mature between March and July. Fruits are said to be green, becoming yellow or brown, and essentially mature ones have been obtained from May to October.

SYNONYMY: The type has somewhat larger leaves than average, and the dimensions given by Tutcher are extreme even for the type specimen, so that the original description is somewhat misleading in this respect. The excellent illustrations published by Herklots are made from an average specimen.

As *I. micranthum*, Léveillé cites collections of Cavalerie and Esquirol not available to me, but I have seen specimens from essentially the same locality, and it seems likely that any plants from Kweichow confusable with *I. micranthum* actually represent *I. Dunnianum*.

A puzzling entity is represented by the collections from Hongkong, Kwangtung, Kwangsi, and Kweichow placed under this entity. Although variation in number of floral parts is extraordinary for § *Cymbostemon*, I have no doubt that the species is a natural one. Its chief characteristics are: small lanceolate leaf-blades with short ascending secondaries which are usually faintly prominulous beneath and sometimes also above; short petioles which are often obviously margined by the decurrent blade; and leaves in pseudoverticils of 3–8, at least at the few distal nodes of each branchlet, this character being here more obvious than in other species, although the leaves throughout the genus are often pseudoverticillate at the distal node or two.

Many flowers have been dissected, with the following results: perianth-segments 12–20; stamens 19–31, but in one bud only 10 stamens were found, and in another flower only 15, so that an extreme variation of 10–31 stamens must be recorded; carpels 8–10 in every flower examined (except 12 in flowers of the type), but two fruiting specimens (*Taam 982* and *Tsang 25703*) which indubitably belong here have the carpels 8–13 in different fruits of the same sheet, so that an extraordinary carpel-variation of 8–13 must be remarked. Because of the diversity in number of floral parts in *I. Dunnianum*, it has been placed in my key in three different places; its true affinity is probably with the relatives of *I. Henryi*.

The complex relationships of the species of §*Cymbostemon* which occur in Hongkong, Kwangtung, and Kwangsi are very difficult to understand, although direct comparison of the seven species involved leaves little doubt that all are good specific entities. It is not to be assumed that my key to the species above, gives a true picture of their relationships; such a picture seems impossible at present. The following key may be found useful in identifying species of this region, although it also is highly artificial.

SUPPLEMENTARY KEY TO THE SPECIES OF § CYMBOSTEMON OCCURRING IN HONGKONG, KWANGTUNG, AND KWANGSI

Style slender, subulate, obviously exceeding the ovary in length at anthesis, usually persisting in fruit as an obvious acumen.

Leaves in pseudoverticils of 3–8 at distal nodes of branchlets, the blades lanceolate or oblanceolate, usually 1.2–2.7 cm. broad, with ascending secondaries usually faintly prominulous beneath; perianth-segments 12–20; stamens usually 19–31, rarely fewer; carpels usually 8–10, sometimes as many as 13; fruit comparatively delicate, with small seeds 4–5 mm. long at maturity .....39. *I. Dunnianum.*

Leaves scattered on branchlets or pseudoverticillate at distal nodes, the blades usually exceeding 2 cm. in breadth; stamens 7–21; fruit comparatively robust, with seeds 6 mm. long or longer at maturity.

Leaf-blades subcoriaceous, the secondaries usually obvious at least beneath; stamens 12–21; carpels (rarely 9–) 11–14; perianth-segments usually 15–21 .....20. *I. majus.*

Leaf-blades thick-coriaceous, the secondaries essentially completely immersed; stamens 7–14; carpels 7–10.

Pedicels 14–32 mm. long at anthesis and in young fruit; perianth-segments 14–17; stamens 7–10 .....31. *I. Tsangii.*

Pedicels 3–5 mm. long at anthesis, not exceeding 9 mm. long in fruit; perianth-segments 9–12; stamens 13 or 14 .....33. *I. pachyphyllum.*

Style shorter than ovary at anthesis or subequal to it, the fruiting carpels merely cuspidate or with a comparatively short acumen.

Carpels 11–13; leaf-blades predominantly oblong or narrowly elliptic.

Perianth-segments 9–11; stamens 14–20 .....21. *I. brevistylum.*

Perianth-segments 21–23; stamens 29 or 30 .....24. *I. leiophyllum.*

Carpels 7–9 (rarely 10); perianth-segments 7–12; stamens 11–20; leaf-blades predominantly obovate-elliptic or oblanceolate; crushed fruits very aromatic .....41. *I. verum.*

40. **Illicium** (§ *Cymbostemon*) **micranthum** Dunn in Hook. Ic. Pl. **28:** *pl. 2714.* 1901; Matsuda in Bot. Mag. Tokyo **21:** (243). 1907; ? Lév. Cat. Pl. Yun-Nan 174. 1916.

Illicium Wangii Hu in Bull. Fan Mem. Inst. Biol. **10:** 120. 1940.

Shrub or small tree, up to 10 m. in height but usually smaller, the branchlets slender, rugulose, the younger ones brownish, subterete or slightly angled, 1–2 mm. in diameter, the older ones often cinereous and up to 3 mm. in diameter; bud-scales minute, fugacious; leaves irregularly alternate or subopposite or 3–5 clustered at distal nodes; petioles slender (1–1.5 mm. in diameter), 4–12 mm. long; leaf-blades coriaceous or thin-coriaceous, when dried dark green or olivaceous on both sides or brownish beneath, elliptic to narrowly oblong-elliptic or lanceolate, (3–) 4–11 cm. long, 1.3–4 (–4.6) cm. broad, obtuse at base, cuspidate to short-acuminate at apex (acumen subacute or obtuse), slightly recurved at margins, the costa impressed above, prominent beneath, the secondary nerves 5–10 per side, slender, often obscure, erecto-patent, slightly prominulous on both surfaces, faintly anastomosing; flowers axillary or subterminal, solitary, the subtending bracts few, papyraceous, oblong, the largest ones 1.5–2 mm. long; pedicels slender, 0.8–1.5 mm. in diameter, 7–28 mm. long at anthesis, usually ebracteolate; perianth-segments 17–20, obscurely pellucid-glandular, the outer ones papyraceous and pale-ciliolate, the inner ones carnose and eciliate, the outermost 3–5 deltoid, 1.8–4 × 2.5–4 mm., the largest ones elliptic, 5–8 × 3.5–8 mm., the innermost 9–11 becoming more carnose and smaller, the smallest ones sometimes only 3 × 1 mm.; stamens 10–12, usually 1-seriate, elliptic-oblong, 2.5–3.5 mm. long, the filaments carnose, ligulate or slightly enlarged distally, 1.3–2.2 mm. long, the connective thickened, truncate or emarginate, the thecae subimmersed, 0.8–1.3 mm. long; carpels 7 or 8, at anthesis 2.3–3.2 mm. long, the ovary flattened-ovoid, 1.3–1.7 mm. long, narrowed into a stout style 1–1.5 mm. long; fruiting pedicel not much enlarged, up to 28 mm. long at full maturity, the carpels 6–8, when mature 9–14 mm. long, 3–7 mm. broad, 2–3.5 mm. thick, the short stout acumen 0.5–3 mm. long; seed pale brown, 4.5–5 × 3–3.5 × 2 mm. at maturity. FIG. 11, m–r.

TYPE LOCALITY: Southern Yünnan, in the general vicinity of Ssu-mao; six specimens collected by Henry are cited by Dunn, without designation of a type, and these are all treated as cotypes below. There seems no doubt as to their being conspecific.

DISTRIBUTION: Southern Yünnan, in the general region drained by the Mekong, and apparently also on O-mei Shan in southern Szechuan. See map, *fig. 13.* Elevations of 1360 to 2200 m. have been recorded, and the habitat is said to be thickets or mixed forest, often in ravines.

CHINA: SZECHUAN: O-mei Shan, *W. P. Fang 3200* (A, K, NY), *7834* (A, K, NY), *7838* (A, K), *F. T. Wang 23258* (A). YÜNNAN: Mountains south of Ssu-mao (Szemao), *A. Henry 12108* (COTYPE COLL., A), *12224B* (COTYPE COLL., A, M, US); Ssu-mao, *A. Henry 12108A* (COTYPE COLL., K, US), *12224* (COTYPE COLL., A, M), *12224A* (COTYPE COLL., K, NY), *12224C* (COTYPE COLL., NY); Mien-ning, *T. T. Yü 17720* (A); Fo-hai (Meng-hai), *C. W. Wang 73695* (type coll., of *I. Wangii,* A, K), *73734* (A), *73851* (A); Lan-ts'ang (Chen-pien) Hsien, *C. W. Wang 76848* (A).

COLOR NOTES: The young flowers are greenish white or yellow, but at anthesis the perianth-segments are apparently red or orange-red; dated flowering specimens were obtained in May. Fruits are green, becoming brownish green, and are mature from July to September.

SYNONYMY: *Wang 73695*, the type collection of *I. Wangii,* is in bud and has underdeveloped leaves, but other specimens collected by Wang at the same place are identical with typical material of *I. micranthum;* there seems no doubt that Hu's species was based upon a depauperate specimen which must be referred to Dunn's species.

Except for the cited specimens from Szechuan, *I. micranthum* appears to have a very compact distribution in southern Yünnan not far from the Mekong valley. The four collections from O-mei Shan cited above are in fruit, in which condition I can find no cause to exclude them from Dunn's species. Examination of flowering specimens of this entity from O-mei Shan should permit either verification of the stated distribution or the description of a novelty, since no other species seems to be concerned.

The species, at least as to its Yünnan component, is very distinct, at once recognized by its small leaves and flowers, comparatively few stamens with submersed thecae, and short-styled carpels. Its relationship to *I. verum* and *I. Dunnianum* is probably more remote than indicated by its position in this treatment.

41. **Illicium** (§ *Cymbostemon*) **verum** Hook. f. in Curtis's Bot. Mag. **114:** *tab. 7005.* 1888, in Kew Bull. **1888:** 173. *pl.* 1888; Karsten, Fl. Deutsch. **2:** 113. *f. 392 (2–4).* 1895; Ohno in Bot. Mag. Tokyo **14:** (41). 1900; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 28. 1905 [repr. Contr. Fl. As. Or. **2:** 28. 1907], in Lecomte, Fl. Gén. Indo-Chine **1:** 30. *f. 6 (1–3).* 1907; Matsuda in Bot. Mag. Tokyo **21:** (243). 1907; Dunn & Tutcher in Kew Bull. Add. Ser. **10:** 28. 1912; Bailey, Stand. Cycl. Hort. **3:** 1641. 1915; (Auth.?) in Jour. Jap. Bot. **1:** (256). *f.* 1918; Hooper in Gard. Bull. Straits Settlem. **6:** 76. 1929; Crevost & Pételot in Bull. Econ. Indochine **32:** 20. *f.* 1929; Burkill, Dict. Econ. Prod. Mal. Penins. 1225. 1935; Merr. in Trans. Am. Philos. Soc. II. **24** (2): 160. 1935; Hoh in Sunyatsenia **4:** 272. *pl. 45, 46.* 1940.

Anisum philippinarum insularum Clus. Rar. Pl. Hist. ccii. 1601.

Zingi fructus stellatus sive Anisum Indicum J. Bauhinus, Hist. Pl. Univ. **1:** 485. 1650.

Illicium anisatum sensu Gaertn. Fruct. et Sem. Pl. **1:** 338. *tab. 69, f. 6.* 1788; Lour. Fl. Cochinch. 353, p. p. 1790; Sieb. & Zucc. Fl. Jap. **1:** 7. 1835; Spach, Hist. Nat. Veg. **7:** 442, p. p. 1839; F.-Vill. Nov. App. Fl. Filip. 3. 1880; Merr. Enum. Phil. Fl. Pl. **2:** 154. 1923; non L.

Illicium San-ki Perr. in Mém. Soc. Linn. Paris **3:** 121 (quoad fr.). 1824; C. B. Robins. in Philip. Jour. Sci. Bot. **3:** 305. 1908; Merr. Enum. Phil. Fl. Pl. **2:** 154. 1923.

Illicium religiosum sensu Forbes & Hemsl. in Jour. Linn. Soc. Bot. **23:** 23. 1886; non Sieb. & Zucc.

Badianifera officinarum Kuntze, Rev. Gen. Pl. **1:** 6. 1891.

Illicium Linnaei Nakai in Bot. Mag. Tokyo **36:** 120. 1922.

Tree, up to 10 or 20 m. high (sometimes reported as a shrub about 5 m. high), the branchlets fairly stout, rugulose, subterete, pale brown to cinereous, 2–3 mm. in diameter distally, up to 5 mm. in diameter below; bud-scales subcoriaceous,

ovate, small, 2–3 mm. long, fugacious; leaves irregularly alternate below, in loose clusters of 3–6 at distal nodes; petioles (5–) 7–18 (–25) mm. long, (0.7–) 1–2 mm. in diameter; leaf-blades coriaceous or thick-coriaceous, olivaceous or green when dried, sometimes pale brown beneath, prevailingly obovate-elliptic or oblanceolate, sometimes oblong-elliptic, (5–) 7–14 (–16) cm. long, (1.5–) 2–5 (–5.5) cm. broad, attenuate at base, cuspidate or short-acuminate at apex (acumen 5–15 mm. long, acute), narrowly revolute at margin, the costa impressed above, prominent beneath, the secondary nerves 5–8 per side, erecto-patent, faintly prominulous on both sides or plane and obscure beneath; flowers axillary or subterminal, solitary, the subtending bracts few, subcoriaceous, deltoid-ovate, about 1.5 × 2 mm.; pedicels rugulose, 14–47 mm. long at anthesis, 1–1.5 in diameter, enlarged distally, usually ebracteolate; perianth-segments 7–12, usually obscurely translucent-glandular, the outer ones papyraceous and pale-ciliolate, the inner ones carnose and usually eciliate, the outermost 2–4 ovate-elliptic to suborbicular, 5–7.5 × 6–9 mm., the largest ones broadly elliptic to obovate, 7–9 × 4.5–11 mm., the innermost ones slightly reduced, the smallest one sometimes only 3.5 × 2 mm.; stamens 1- or 2-seriate, 11–20, broadly oblong, 1.8–3 mm. long, the filaments carnose, 0.5–1.6 mm. long, often contracted proximally, thickened distally, the connective truncate, the thecae slightly protuberant, 1–1.5 mm. long; carpels usually 8 or 9, rarely 10, perhaps occasionally 7, at anthesis 2.5–3.7 mm. long, the ovary flattened-ellipsoid, 1.2–2 mm. long, the style stout-subulate, subequal to ovary in length; fruiting pedicel slightly enlarged, 20–56 mm. long at full maturity, the carpels 7–9 (rarely 10), when mature 14–20 mm. long, 7–12 mm. broad, 4–6 mm. thick, gradually tapering to a stout conical acumen 1–2 mm. long; seed brown, 7–9 × 4.5–6 × 2.5–3 mm. at maturity.

TYPE LOCALITY: Hooker's original drawing of *I. verum* was made from a plant which flowered at Kew in Nov. 1887; a specimen from this plant in the Kew Herbarium, cited below, is to be considered the actual type. The Kew plant was sent from Hongkong by Ford in 1883, and Ford's seedlings were obtained in Pei-hai (Pakhoi) by a Mr. Kopsch. The species is known to occur, either wild or cultivated, in the region accessible from Pei-hai. The Ford specimens cited below as being cultivated in Hongkong doubtless came from the same parent stock as the type specimen, with which they agree perfectly.

DISTRIBUTION: Southeastern China (Kwangsi and southern Kwangtung) and adjacent northeastern Indo-China, perhaps cultivated in a somewhat wider area. See map, *fig. 13.* Altitudes of 600–1600 m. are recorded for the native plant, but it may be cultivated at lower elevations. Habitats of forest, mixed or shaded woods, thickets, or woods along streams have been mentioned.

CHINA: KWANGTUNG: Sup-man-ta Shan, near Kwangsi border, Fang-ch'eng Hsien, *H. Y. Liang 69788* (A); Na-leung River, Sup-man-ta Shan, Fang-ch'eng Hsien, *H. Y. Liang 69472* (A); Na-leung [Na-liang-hsü] and vicinity, Fang-ch'eng Hsien, *W. T. Tsang 26556* (A), *26605* (A); Kung-p'ing Shan and vicinity, T'aan-faan, Fang-ch'eng Hsien, *W. T. Tsang 26670* (A); without locality (mixed label), *H. Y. Liang 70155* (A). KWANGSI: T'eng Hsien, *L. H. Chun 91364* (A); Ku-lung, T'eng Hsien, *L. H. Chun 91204* (A), *91343* (A), *91344* (A), *91345* (A); Yao Shan, Tseung-yüen, P'ing-nan Hsien, *C. Wang 39370* (A), *39481* (A); Yao Shan, P'ing-nan Hsien, *C. Wang 40091* (A), *40305* (A); Na-i, Ling-yün (Ssu-ch'eng) Hsien, cultivated, *A. N. Steward & H. C. Cheo 537* (A, NY); Tsin-hung Shan, N. Hin-yen, *R. C. Ching 6825* (A, NY, US), *6843* (A, UC, US); Ba-ko Shan, W. Pai-se, *R. C. Ching 7589* (A, NY, UC, US); without locality, *H. B. Morse* (in A. Henry) *201* (NY).

INDO-CHINA: No specimens available, but the reference to the indigenous occurrence of the species in the extreme northeastern part of the country by several authors is doubtless trustworthy, since it is known from immediately adjacent China.

CULTIVATED: *Cult. Kew* (K TYPE) (from a plant sent from Hongkong by C. Ford in 1883); *C. Ford*, Nov. 1886 (K) (Hongkong Bot. Gard.); *C. Ford* (or *A. Henry*), in 1898 (?) (NY, US) (cult. Hongkong); *? A. S. Hitchcock*, June, July, 1898 (Ch) (cult. Miami, Fla.).

LOCAL NAMES, USES, and COLOR NOTES: Numerous local names are recorded for *I. verum*, the only member of the genus of important commercial value. The more often quoted of

these are as follows: *Star anise* (English); *Anis étoilé* (French); *Sternanis* (German); *Pa-ko* and numerous variants (Chinese); *Dai-höi* or *Bát-giác-huong* and variants (Indo-Chinese); *Adas china* or *Adas manis* or *Bunga lawang* (fr.) (Malayan); *San-ki* (used by Chinese in Manila).

A volatile oil is distilled from the fruits, leaves, and twigs of *I. verum*, and the entire supply of this oil is exported from southeastern China and adjacent Indo-China; the plant is extensively cultivated in the region of its native occurrence. Principal uses of the product are in medicine, as a condiment, or in flavoring liqueurs such as absinthe and anisette. An excellent summary by Hoh (1940) may be consulted for data pertaining to distribution, cultural methods, harvesting, distillation, etc. The three products of commercial importance are the dried fruits (*Pa-kioh*), the oil distilled from fresh fruits, and the oil distilled from leaves and twigs. Further important information is contained in the treatments of Hooper (1929), Crevost & Pételot (1929), and Burkill (1935) cited above.

The young flowers are apparently white to yellow, but at maturity the perianth-segments are deep rose, pinkish, or purplish, the outermost probably somewhat greenish. According to Hoh there are two flowering seasons, (1) July and August, and (2) November and December. Fruits mature about four months after flowering; they are at first green, subsequently yellowish to brownish yellow.

Synonymy: Although the botanical identity of this species was not clarified until 1888, it was actually the first member of the genus mentioned in European literature—a not surprising fact because it is the only species with medicinal potentialities. Clusius' discussion of *Anisum philippinarum insularum* (1601) certainly pertains to *I. verum*. Robinson (in Philip. Jour. Sci. Bot. **3**: 305. 1908) states: "The fruits of the star-anise were the first vegetable products described as Philippine, taken hence to Europe by Cavendish in 1587. The name 'San-ki' is still used by the Chinese of Manila for this species, but it is not a native of this Archipelago, and not known here except as imported." Bauhin's early reference to *Zingi fructus stellatus* . . . (1650) appears to discuss the same entity as was available to Clusius.

After Linnaeus' establishment of the genus and the Japanese species, subsequent workers took his binomial to apply to the southern species; it is generally supposed that the treatments of Gaertner (1788) and Loureiro (1790) pertain primarily to *I. verum*. This unwarranted extension of the binomial *I. anisatum* has caused confusion in the literature on *Illicium* extending into recent times.

A post-Linnaean binomial which has priority over *I. verum* is *I. San-ki* Perr. (1824), but fortunately this may be excluded as a mixed name. According to the clarifying treatments of Robinson (1908) and Merrill (1923), Perrottet described the fruit of the imported star anise (known in Manila as *San-ki*) and the leaves of some other plant, probably *Clausena Anisum-olens* (Blanco) Merr. according to Robinson. Since only the non-Philippine fruits of *I. verum* are concerned in Perrottet's unfortunate binomial, it may surely be excluded from serious consideration.

Forbes & Hemsley's mention of *I. religiosum* cited above, at least as to the Ford plant from Pakhoi (Pei-hai) which they list, is certainly referable to *I. verum*.

Kuntze's binomial *Badianifera officinarum* was based on *Illicium anisatum* sensu Lour. and is therefore to be cited in the present synonymy.

Nakai, in 1922, taking *I. anisatum* L. to be a mixture, excluded the name, using *I. religiosum* for the Japanese element and coining the binomial *I. Linnaei* for the Chinese element which is presumably the common cultivated species, in spite of the already existing binomial of Hooker.

Illicium verum is one of the most distinct species in the genus, being instantly recognizable not only by its leaves and flowers, but also by the fragrance of its crushed fruits and by morphological details such as the presence of oil-cells in the endothecium of the anthers.

42. **Illicium** (§ *Cymbostemon*) **Petelotii** sp. nov.

Illicium micranthum sensu Merr. in Univ. Calif. Publ. Bot. **13**: 131. 1926; non Dunn.

Arbor parva (?), ramulis rugulosis, hornotinis brunneis gracilibus (1.5–3 mm. diametro) subteretibus vel leviter angulatis, vetustioribus cinereis ad 5 mm. diametro; squammis subcoriaceis oblongis acutis 3–5 mm. longis fugacibus; foliis inferne irregulariter alternatis superne 3–6 ad nodos aggregatis; petiolis superne

alatis 5–18 (–23) mm. longis 1–2 mm. diametro; laminis tenuiter coriaceis in sicco utrinque fuscis, oblongo-ellipticis vel anguste obovatis, (4–) 6–14 cm. longis, (1.5–) 1.8–4.2 cm. latis, basi obtusis vel acutis, in apicem calloso-acutum cuspidatis vel breviter acuminatis, margine anguste recurvatis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 6–12 gracilibus subpatentibus utrinque prominulis vel supra subplanis marginem versus obscure anastomosantibus; floribus axillaribus vel subterminalibus vel infra folia lateralibus solitariis, bracteis basalibus paucis minutis caducis; pedicellis gracillimis (0.5–0.7 mm. diametro; apicem versus ad 1 mm. incrassatis) longitudine variabilibus (sub anthesi 5–45 mm. longis sub fructu juvenili raro ad 57 mm. longis) ebracteolatis; segmentis perianthii 11–13 obscure pellucido-glandulosis, exterioribus papyraceis vel submembranaceis breviter ciliolatis, interioribus plerumque tenuiter carnosis eciliatis, extimis 1–4 ellipticis 3.5–6 × 3.5–5 mm., maximis ellipticis vel

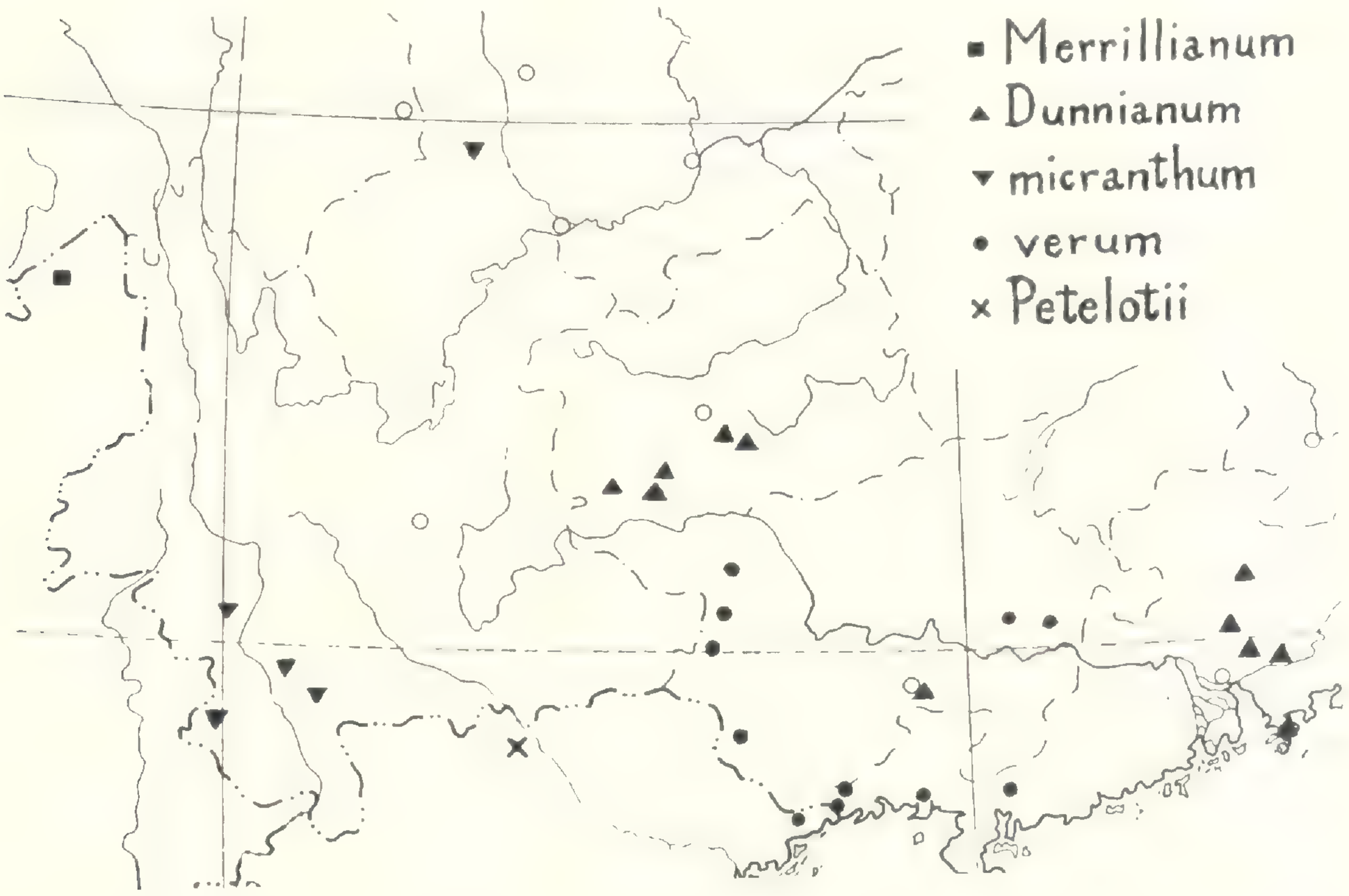

FIG. 13. Approximate known distribution of *I. Merrillianum, I. Dunnianum, I. micranthum, I. verum* (indigenous), and *I. Petelotii.*

obovatis 6–8 × 4–6.5 mm., intimis 5 vel 6 gradatim reductis, minimis saepe circiter 3 × 2 mm.; staminibus 9–14 plerumque 1-seriatis 2.2–3.5 mm. longis, filamentis ligulatis inferne contractis superne incrassatis 1.4–2.4 mm. longis, connectivo carnoso obtuso vel emarginato, thecis leviter protuberantibus 0.8–1.2 mm. longis; carpellis (5–) 6–8 sub anthesi 2.3–3.2 mm. longis, ovario triquetro-ovoideo 1.2–1.8 mm. longo in stylum subulatum 1–1.5 mm. longum angustato; pedicellis sub fructu haud incrassatis carpellis maturis 5–7 circiter 14–15 × 6 × 3.5 mm. in acuminem brevem ad 3 mm. longum angustatis; semine pallido-brunneo circiter 6 × 4.5 × 3 mm.

TYPE LOCALITY: Cha Pa, Tonkin, Indo-China; type, *Pételot 1776.*

DISTRIBUTION: Known only from the type locality, at elevations of 1500–2000 m., in forest. See map, *fig. 13.*

INDO-CHINA: TONKIN: Cha Pa, *A. Pételot 1776* (A TYPE, UC), Apr. 1925, *3759* (A), *6345* (A, NY).

COLOR NOTES: No data as to flower-color are available; mature flowers have been collected only in April, and the green fruits of no. *3759* were obtained in August.

SYNONYMY: The cited reference to *I. micranthum* lists only *Pételot 1776.*

There is some discrepancy between the two available flowering specimens as to length of pedicel, but otherwise I find no characters to separate the cited specimens, which appear to represent a fairly coherent species. The alliance of *I. Petelotii* is definitely with *I. micranthum* and *I. verum*, but the characters mentioned in the key serve readily to differentiate the three species.

EXCLUDED ENTITIES

Ternstroemia evenia (King) comb. nov.

Illicium evenium King in Jour. As. Soc. Beng. **58** (*2*): 374. 1889; Ridley, Fl. Malay Penins. **1**: 19. 1922.

Ternstroemia Scortechinii King in Jour. As. Soc. Beng. **59** (*2*): 193. 1890, in Ann. Bot. Gard. Calcutta **5** (*2*): 145. *pl. 175.* 1896; Ridley, Fl. Malay Penins. **1**: 198. 1922.

In his original description of *Illicium evenium,* King points out that the unisexual flowers are unique in the genus. Fortunately, a duplicate of the type (*Scortechini* [K], Perak) is available, and dissection of a bud establishes the fact that a species of *Ternstroemia* is represented. The flowers are too young to permit a careful analysis of the perianth, but the stamens are clearly seen to be about 60 (rather than 30–50 as stated by King), and there is no trace of an ovary.

A duplicate of what is presumably a cotype collection of *Ternstroemia Scortechinii* is also available (*King's Collector 3756* [A], Perak); this specimen, in fruit, and the Scortechini collection are quite identical in foliage. King's descriptions and plate permit no doubt that the same species is concerned in the two binomials. This similarity was known to King, as he mentioned under *Ternstroemia Scortechinii:* "A very distinct species with leaves curiously like those of *Illicium evenium,* . . ."

ILLICIUM LAURIFOLIUM Hort. ex André in Rev. Hort. **73**: 16. *f. 1.* 1901; Bailey, Stand. Cycl. Hort. **3**: 1641. 1915.

This binomial, based upon a plant of unknown origin cultivated in "les pépinières de MM. Besson frères, horticulteurs à Nice," is referable to the synonymy of **Drimys Winteri** var. **chilensis** (DC.) A. Gray, which is known to be in cultivation. André's binomial should have been cited by me in Jour. Arnold Arb. **24**: 18. 1943, in my revision of the American species of *Drimys.*

INSUFFICIENTLY KNOWN ENTITIES

ILLICIUM RETICULATUM Raf. Autikon Bot. 86. 1840.

The entire entry states: ". . . ramulis angulatis, fol, subpetiol. oblongis subcuneatis angustis acutis utrinque latere reticulatis—Florida, found by Kin, leaves evergreen pale beneath biuncial, one third inch broad, certainly not the I. floridanum with acuminate leaves."

From this, one is at a loss to place Rafinesque's plant, or even to know whether or not an *Illicium* was under consideration.

ILLICIUM VARIEGATUM Hort. in Gard. Chron. **1861**: 735. 1861.

Illicium religiosum f. *variegatum* Hort. ex Beissn., Schelle, & Zabel, Handb. Laubh.-Benen. 102. 1903.

The original description, from an anonymous article dealing with a display of Japanese plants, states: "A neat-looking plant, probably referrible (sic) to

I. anisatum. It had grey-marbled leaves, slightly edged with white, and was commended as a pretty variegated shrub."

Index Kewensis refers this binomial to *I. anisatum,* but from the above it seems impossible to guess what the writer had in hand; no variegated foliage in *Illicium* is known to me.

ILLICIUM JAPONICUM var. FOL. RUBRO-MARG. (sic) Morren & de Vos, Ind. Bibl. Hort. Belg. 437, nomen. 1887.

The full entry states: "Japon.—L. Van Houtte, Exp. Gand, 2 mars 1862." It is impossible to suggest the position of this name, and that it belongs in the genus is highly dubious.

ILLICIUM ACUDENTATA L. ex B. D. Jacks. in Proc. Linn. Soc. **124**: Suppl. 89, nomen. 1912.
Illicium occidentale L. ex Savage, Cat. Linn. Herb. 95, nomen. 1945.

The specimen referred to in the above citations is, in the set of photographs recently made in London, numbered 704.1, under which number it is listed in Savage's Catalogue. A print of this photograph is available at the Arnold Arboretum. The hand-written specific epithet is doubtless *"occidentale,"* but it could readily be mistaken for *"acudentata;"* it is obvious that Jackson and Savage are referring to the same specimen in the Linnaean Herbarium. Unfortunately neither catalogue contains data of assistance in placing the geographical locale of this specimen. From the photograph I cannot be certain whether or not a species of *Illicium* is shown; the general facies is good for the genus, but some of the leaves seem to be inconspicuously sinuate-dentate, a character not known in *Illicium.* Under the circumstances I am unable to refer these binomials to the correct synonymy.

SCHISANDRACEAE

HISTORY

For the first reference in European literature to a species belonging to the Schisandraceae one must turn to Kaempfer's Amoenitatum Exoticarum (25) of 1712, in which is described the plant which subsequently became the basis of *Kadsura japonica.* This plant was described by Linnaeus (Sp. Pl. 536. 1753) as *Uvaria japonica.* It is the only member of either the Schisandraceae or the Illiciaceae to have been mentioned in the first edition of Species Plantarum.

In the early part of 1803 were published, nearly simultaneously, descriptions of two monotypic genera, *Stellandria* Brickell (in Med. Repos. New York **6** [no. 3]: 327) and *Schisandra* Michaux (Fl. Bor.-Am. **2**: 218). Both of these were based upon the only American species of the family, treated in this paper as *Schisandra glabra* (Brickell) Rehder. Although it appears that Brickell's publication has priority by a few weeks, his generic name has universally been overlooked in favor of *Schisandra.* The latter was proposed for conservation by Rehder (33) in 1944, and such conservation seems imperative in order to preserve Michaux's well-known generic name.

The genus *Kadsura* was not proposed until 1810, when Jussieu (in Ann. Mus. Hist. Nat. **16**: 340) suggested the name, accrediting it to Kaempfer, and citing Kaempfer's original discussion and "*Uvaria japonica* Thunb." in synonymy. Jussieu referred his new genus to the "Anonées" with doubt. Although no binomial was given by Jussieu, his publication of the genus may be taken as adequate, since there is no doubt of its circumscription. The first reference of a

binomial to *Kadsura* was in 1817, when Dunal (Monogr. Anon. 57) based his *Kadsura japonica* upon *Uvaria japonica* L.

De Candolle (Reg. Veg. Syst. Nat. **1**: 465. 1817) and some subsequent writers followed Jussieu in referring *Kadsura* to the Annonaceae. De Candolle also established the custom of referring *Schisandra* to the Menispermaceae, placing it in a separate tribe, the *Spuriae* (op. cit. 543). The same disposition of these two genera was suggested by de Candolle in the Prodromus (**1**: 83, 104. 1824), and the weight of his authority perhaps dissuaded subsequent students from inquiring into the true relationships of the two genera.

The occurrence of the Schisandraceae in the Himalayan region was first indicated in 1824 by Wallich (43: 9–12), who described *Kadsura grandiflora* (= *Schisandra grandiflora*) and *K. propinqua* (= *Schisandra propinqua*); a third species, referred *to K. japonica*, was later made the basis of *Kadsura Roxburghiana* (= *K. heteroclita* in the present treatment). In 1825 Blume (12: 21–23) noted the presence of the family in Java, describing two new genera (*Sarcocarpon* and *Sphaerostema*) and three new species, these being referable to *Kadsura scandens*, *Schisandra axillaris*, and *S. elongata*. Although Blume placed his new genera in the Annonaceae, he noted that they, probably together with *Schisandra*, might constitute a new family intermediate between the Annonaceae and Menispermaceae.

Although anticipated by Guillemin's discussion (in Dict. Class. Hist. Nat. **15**: 239. 1829), Blume, in 1830 (13), was the first writer seriously to propose founding a new family upon this group of genera. In this important and elaborate publication Blume described the family "Schizandreae," on the basis of the genera *Kadsura* (including *Sarcocarpon*), *Sphaerostema*, and *Schisandra*, pointing out its probable alliance to the Magnoliaceae. Because of the incorrect termination of "Schizandreae," neither Blume's nor Guillemin's publications can be accepted as establishing the family name. Such establishment, however, may be dated from Don's treatment of 1831 (16), where the "Order" "Schizandriaceae" is established, with five genera and ten species (of which one genus, *Mayna*, with three species, is out of place).

In the subsequent decades a few new species referable to the Schisandraceae were proposed, the family began to assume its now known geographical limits, and the family name was utilized to a limited degree. Doubtless due in large part to the authority of Bentham and Hooker f. (Gen. Pl. **1**: 19. 1862), however, *Schisandra* and *Kadsura* were generally referred to the Magnoliaceae, in a tribe or subfamily under one or another name.

Only a few of the more important treatments of the group will be mentioned in the rest of this summary, references to standard floristic works being omitted; such references will be found throughout the text below. The generic names *Cosbaea* Lem. (in Illustr. Hort. **2**: 71. 1855) and *Maximowiczia* Rupr. (in Bull. Phys.-Math. Acad. Sci. St. Pétersb. **15**: 142. 1856) should be noted as important; these entities have considerable reason and, as will be discussed below, each is the basis of a section, in *Kadsura* and *Schisandra* respectively. In his important paper on the Indian Magnoliaceae of 1891, King (26) described the four species of *Schisandra* and the five species of *Kadsura* known to him from the region. Finet & Gagnepain (18), in 1905, keyed and discussed the 12 species of *Schisandra* and *Kadsura* known to them from eastern Asia, but their specific concepts do not appear very reliable in this instance. Rehder & Wilson's study of 1913 based on Wilson's Chinese plants (34) includes a discussion of several

Asiatic species of *Schisandra* and *Kadsura,* with several novelties. Some of the confusion surrounding the identification of certain Chinese *Schisandrae* was clarified in Stapf's treatment (41) of 1928. Nakai's work (29) of 1933 includes descriptions of species of *Schisandra* and *Kadsura* in Korea and Japan, and is further important for its comprehensive bibliography and his proposal of three sections in *Schisandra.*

It is apparent, therefore, that the Schisandraceae have never received anything approaching a comprehensive taxonomic treatment. Except for the authors of a few regional floras and horticultural works, writers on the group have limited themselves to so few species that no real understanding of specific relationships could have been grasped. Herbarium identifications here, as in the Illiciaceae, have been haphazard, and in fact could not have been otherwise until the present substantial accumulation of herbarium material became available. My recognition of 25 species in *Schisandra* and 22 in *Kadsura,* while certainly susceptible of future revision, will, it is hoped, give a reasonable approximation of the size of the family.

Local names and uses

Some species of the Schisandraceae have been accredited with numerous local names; the more authentic of these will be found listed below with each species. One name which is very prevalent in northern and central China for *Schisandra chinensis* or some superficially similar species is *Wu-wei-tzu,* or a variant, meaning "five tastes plant." For *Kadsura japonica* there are many variants of the names *Sane-kadsura* and *Binan-kadsura,* these local names having been modified into the generic name.

The fruits of many species of the Schisandraceae are edible; collectors report the fruits as sweet or insipid, or sometimes as astringent. The edible portion is doubtless the pulp surrounding the hard seeds, and perhaps the outer layer of the pericarp as well. Among the species which are mentioned (for the most part rather vaguely) as supplying a local "medicine" are *Schisandra chinensis, S. repanda, Kadsura scandens, K. japonica,* and *K. heteroclita.* The fruits of at least some of these species are sold at local markets. In Japan a viscid material used as a hair-dressing is extracted from the fruits of *Schisandra chinensis* and *Kadsura japonica,* and the latter of these is said further to yield a mucilaginous fluid which the Japanese use in paper-making.

No species of the Schisandraceae has any real economic value equal to that of *Illicium verum.*

Taxonomic treatment

Schisandraceae G. Don, Gen. Syst. **1:** 101, as *Schizandriaceae.* 1831.

Menispermeae trib. *Spuriae* DC. Reg. Veg. Syst. Nat. **1:** 543. 1817.

Menispermaceae trib. *Schizandreae* DC. Prodr. **1:** 104. 1824; Spach, Hist. Nat. Veg. **8:** 8. 1839.

Laurineae a. *Menispermeae* cc. *Schizandreae* Reichenb. Consp. 86. 1828.

Schizandreae Bl. ex Guillem. in Dict. Class. Hist. Nat. **15:** 239. 1829; Bl. Fl. Jav. [Schizandr.] 3. 1830; Lindl. Nixus Pl. 9. 1833; Bl. in Ann. Sci. Nat. II. **2:** 91. 1834; Walp. Rep. Bot. Syst. **1:** 92. 1842, **2:** 15. 1845; Brongn. Enum. Gen. Pl. 95. 1843; Miq. Fl. Ned. Ind. **1** (2): 18. 1858; Le Maout & Dec. Traité Gén. Bot. 378. 1878.

Menispermidae trib. *Schizandreae* DC. ex Dumort. Anal. Fam. Pl. 50. 1829.

Schizandraceae Bl. ex Mart. Consp. Reg. Veg. 39. 1835; Loudon, Arb. et Frut. Brit. **1:** 295. 1838; Torr. & Gray, Fl. N. Am. **1:** 45. 1838; Arn. in Mag. Zool. and Bot. **2:** 546.

1838; Endl. Gen. Pl. 835. 1839, Enchir. Bot. 425. 1841; Schnizl. Iconogr. **3**: no. 175. 1843–70; Hassk. Cat. Pl. Hort. Bot. Bog. 177. 1844; Sieb. & Zucc. in Abh. Bayer. Akad. Wiss. Math. Phys. Cl. **4** (2): 188. 1845; A. Juss. in Orbigny, Dict. Univ. Hist. Nat. **11**: 416. 1848; Hook. f. & Thoms. Fl. Ind. **1**: 82. 1855; Darby, Bot. Southern States **2**: 213. 1855; Walp. Ann. Bot. **4**: 78. 1857; Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Etrang. **9**: 31. 1859; Drury, Hand-book Fl. Ind. **1**: 647. 1864; Luerssen, Grundzüge Bot. 343. 1877; Ridley, Fl. Malay Penins. **1**: 20. 1922; Craib, Fl. Siam Enum. **1**: 27. 1925; Hutchinson, Fam. Fl. Pl. Dicot. 83. 1926.

Menispermaceae trib. *Schizandraceae* Meisn. Pl. Vasc. Gen. 5. 1836, pars alt. 7. 1843.

Paeoniaceae d. *Annoneae, Schizandreae* Horaninow, Tetract. Nat. 31. 1843.

Paeoniaceae trib. *Anonariae* d. *Schizandreae* Horaninow, Char. Ess. Fam. Reg. Veg. 176. 1847.

Magnoliaceae subord. *Schizandreae* A. Gray, Gen. Pl. U. S. **1**: 54. 1849; Chapman, Fl. Southern U. S. 12. 1860.

Magnoliaceae trib. *Schizandreae* Benth. & Hook. f. Gen. Pl. **1**: 19. 1862; Walp. Ann. Bot. **7**: 48. 1868; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 39. 1872; Hemsl. in Garden **8**: 271. 1875; Nichols. Ill. Dict. Gard. **3**: 383. 1887; Boerlage, Handl. Fl. Ned. Ind. **1**: 9. 1890; King in Ann. Bot. Gard. Calcutta **3**: 199. 1891; Matsuda in Jour. Coll. Sci. Tokyo **6**: 127. 1893; A. Gray, Syn. Fl. N. Am. **1**: 58. 1895; Nakai, Fl. Sylv. Koreana **20**: 99. 1933.

Schizandrées Baill. in Adansonia **3**: 42. 1862.

Magnoliacées ser. *Schizandrées* Baill. Hist. Pl. **1**: 151. 1868–69.

Magnoliacées ser. *Kadsurées* Baill. Hist. Pl. **1**: 150, as synonym. 1868–69.

Magnoliacées ser. *Schizandreae* Baill. Hist. Pl. **1**: 189. 1868–69.

Menispermaceae subfam. *Schisandreae* K. Koch, Dendr. **1**: 385. 1869; Lauche, Deutsche Dendr. 359. 1880.

Magnoliaceae IV. *Schizandreae* Eichl. Blüthendiagr. **2**: 151. 1878.

Magnoliaceae II. *Schizandreae* Prantl in E. & P. Nat. Pfl. III. **2**: 17. 1888; Dalla Torre & Harms, Gen. Siphon. 171. 1901.

Magnoliaceae subfam. *Schisandreae* Dippel, Handb. Laubholzk. **3**: 155. 1893; Schneid. Ill. Handb. Laubholzk. **1**: 340. 1905.

Magnoliaceae subfam. *Schizandreae* Koehne, Deutsche Dendr. 145, 147. 1893; Beissn., Schelle, & Zabel, Handb. Laubh.-Benen. 102. 1903.

Magnoliaceae II. *Schizandroideae* Harms in Ber. Deutsch. Bot. Ges. **15**: 358. 1897.

Magnoliacées trib. *Schizandrées* Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 48. 1905 [repr. Contr. Fl. As. Or. **2**: 48. 1907].

Magnoliaceae subfam. *Schizandroideae* Harms ex Rehder, Man. Cult. Trees and Shrubs ed. 2. 246. 1940.

Scrambling or twining woody vines, often high-climbing, monoecious or dioecious, the branches alternately branching, the older parts lenticellate but usually not conspicuously so, the new branchlets subtended by bud-scales, these imbricate, few to many, fugacious to subpersistent; leaves alternate or congested, exstipulate, petiolate, the blades simple; flowers variously arranged, most often solitary and axillary to foliage leaves on ultimate branchlets or in axils of fugacious bracts near base of ultimate shoots, often paired, sometimes aggregated and glomerulate on ultimate shoots or on main branches, pedicellate, the flower-subtending bracts inconspicuous; pedicels ebracteolate to several-bracteolate; flowers unisexual, hypogynous, with few to numerous parts, the torus often highly modified; perianth-segments free, 2–several-seriate, few to many, all essentially similar or the outermost and innermost ones reduced and modified in texture; androecium various, composed of few to many (4–80) stamens variously aggregated, with essentially basifixed 4-sporangiate anthers, the 2 thecae dehiscing by longitudinal clefts for their entire length; filaments at least basally fused into a modified column, this simple or elongate or flattened or subglobose or clavate, the anthers with short free filaments or sessile or subimmersed in the tissue of the column, the connective

scarcely or slightly swollen or greatly broadened, the thecae essentially vertical, lateral or extrorse (dorsal) or introrse (ventral), contiguous or separated by connective-tissue; gynoecium subglobose to ovoid or ellipsoid, composed of a column and numerous (12–300) few- to many-seriate carpels, the column cylindric to conical (*Schisandra*) or obovoid to ellipsoid (*Kadsura*), the carpels spreading or subascending, frequently narrowed at base, the ovary ovoid to obovoid, conduplicate, when young essentially open ventrally, the ventral side with two parallel longitudinal stigmatic crests, these membranaceous to soft-carnose, flaring or inconspicuous, often erosulous to ciliolate at margins, usually distally produced into an essentially unvascularized pseudostyle, this subulate or conical or laterally flattened or modified at apex into a subpeltate pseudostigma, the stigmatic crests proximally decurrent on the ovary-wall or extended into 1–3 irregularly oblong appendages, these unvascularized; locule 1, sometimes partially divided by outgrowths from the lateral walls, the ovules 2–5 (rarely to 11), collateral to superposed, anatropous, ventrally attached or pendulous, ellipsoid to subglobose and flattened, fairly uniform in size (at anthesis 0.3–0.6 mm. in diameter); fruit aggregate, baccate, composed of a modified torus (elongate in *Schisandra,* subellipsoid in *Kadsura*) and sessile drupe-like carpels; carpels in fruit indehiscent, subglobose to ellipsoid or obovoid, the remnants of the pseudostyle or pseudostigma hardly apparent at maturity, the pericarp carnose when fresh, often drying coriaceous, sometimes flattening to show shape of seeds in drying; seeds 1–5 or rarely more, ventrally attached or pendulous, laterally flattened, ellipsoid to subglobose or reniform or ovoid, the hilar indentation obvious or inconspicuous, on long or short axis of seed, the hilar scar transversely oblong or elliptic, often conspicuous, the testa hard or brittle, smooth to rugulose or tuberculate, the endosperm copious, oily, the embryo small, near the hilum.

TYPE GENUS: *Schisandra* Michx.

DISTRIBUTION: Southeastern Asia from Sakhalin and southeastern Siberia to India, and southward in Malaysia to Amboina and Java; also in the southeastern U. S. See map, *fig. 2.* I interpret the family to consist of 2 genera and 47 species.

The synonymy of the family, given above, provides a summary of the various interpretations of the group. By failing to list any authorities for the correct spelling Schisandraceae I do not imply that this spelling has not previously been used; actually several writers have used it in compiling lists, etc. But in listing references I have limited myself to those treatments in which a description, or at least an adequate circumscription by use in a key or by a discussion of genera, is given.

Apparently Guillemin, anticipating Blume by a year, was the first to express the opinion that *Schisandra* and its allies were worthy of separation from the Menispermaceae. Guillemin in 1829 briefly noted the "famille" Schizandreae, with two genera, *Schisandra* and *Sarcocarpon,* accrediting the name to Blume. In his elaborate treatment of 1830 (13), Blume also proposed the Schisandreae as a new family, with the Javanese species of *Kadsura* and *Sphaerostema.* Neither Guillemin nor Blume, however, used the correct family termination, and therefore their expressed desire to establish the family must be disregarded, according to Art. 23 of the International Rules of Botanical Nomenclature (ed. 3. 1935).

In 1831, however, G. Don proposed the family name with the correct termination, but in a misspelled form, as Schizandriaceae. Apparently this proposal meets the fundamental requirements of the International Rules, and therefore I accept Don as the author of the family name, correcting it to Schisandraceae, since the spelling of the type genus is *Schisandra* and not *Schizandra,* as will be discussed following my description of the genus. Don's treatment is entirely ade-

quate, including a description of the family and all the species known to him, which he placed in the genera *Schizandra, Sarcocarpum, Sphaerostemma, Kadsura*, and *Mayna*. The last of these, of course, is a discordant element, which many other early writers linked with *Schisandra* and *Kadsura*.

It is not necessary to discuss further the diverse interpretations of this group of genera, but it should be noted that more recent authorities (e. g. A. Gray, Bentham & Hooker, Baillon, Prantl, Harms, etc.) have been inclined to give subfamily or tribal status under the Magnoliaceae to an entity composed of *Schisandra* and *Kadsura*. Curiously it has not been suggested that these genera be combined with *Illicium* in any grouping, and yet the alliance of these three genera is unquestionable. The desirability of separating these three genera from the Magnoliaceae has been discussed earlier in this paper.

Key to the genera based on ♀ flowers and fruits

Flowers with the torus modified into a cylindric or conical terete column, this distinctly longer than broad; ovary-wall uniform in thickness or slightly thicker distally than proximally; pseudostyle flattened or subulate or conical, rarely lacking; ovules 2, rarely 3, ventrally attached; torus greatly elongating in fruit, the carpels scattered or crowded, the pericarp uniform in thickness; seeds 2 (rarely 1 or 3), the hilar indentation lateral, the testa smooth to rugulose or tuberculate .....1. *Schisandra*.

Flowers with the torus modified into an obovoid or subclavate or ellipsoid column, this somewhat longer than broad but distinctly narrower at base than distally; ovary-wall uniform in thickness or conspicuously thicker distally than proximally; pseudostyle subulate or laterally flattened or modified at apex into a peltate or irregular pseudostigma; ovules 2–5 (rarely –11), ventrally attached or pendulous; torus ellipsoid or clavate in fruit, the carpels aggregated into a subglobose or ellipsoid head, the pericarp uniform in thickness or greatly thickened distally; seeds 2–5 (rarely 1–11), the hilar indentation lateral or uppermost, the testa smooth .....2. *Kadsura*.

Key to the genera and sections based on ♂ flowers

Androecium composed of a sessile pentagonal flattened shield consisting of 5 radiating stamens, the thecae borne on the lower (dorsal) margins of anthers; perianth-segments 7–13 .....*Schisandra* § *Euschisandra*.

Androecium composed of a subglobose or obovoid mass bearing 5–16 stamens in shallow or circular cavities on its surface, the anthers at length free and reflexed or remaining immersed in cavities, the thecae introrse; perianth-segments 6–20.
Schisandra § *Sphaerostema*.

Androecium composed of essentially free stamens (uppermost ones sometimes imperfectly coadnate), the anthers sessile or stalked, the column various but less highly modified than in the two sections above.

Column poorly defined and inconspicuous, or slender and cylindric, or conical and sometimes with sterile distal appendages, only rarely subclavate; connective comparatively inconspicuous, longer than broad.

Stamens 4 or 5 (rarely 6), the anthers sessile at apex of a slender terete column, the thecae extrorse-lateral; perianth-segments 5–10 .....*Schisandra* § *Maximowiczia*.

Stamens 8–70, the column not as well-defined as in the preceding.

Column often inconspicuous or subconical, the composing filaments often separable; uppermost stamens sometimes coadnate into an imperfectly theciferous mass; thecae usually subparallel, not contiguous at apex, sometimes contiguous at base; perianth-segments 5–10, subequal or enlarging inward ..*Schisandra* § *Pleiostema*.

Column conical or elongate-conical (rarely merely rounded), often with sterile distal appendages; stamens always free; thecae curved, contiguous at apex, separated at base; perianth-segments 10–16, conspicuously enlarging inward.
Kadsura § *Cosbaea*.

Column distinctly subclavate; free portions of filaments minute, the connective greatly enlarged, the thecae separated by the width of the connective or at least by its projecting dorsal angle.

Connective transversely oblong-ellipsoid, the thecae strictly lateral, separated by the entire width of the connective, the thecae of adjacent stamens contiguous and often closely appressed; perianth-segments 8–19 ..... *Kadsura* § *Eukadsura.*

Connective oblong-turbinate or obovoid, irregularly pentagonal at apex, the thecae lateral-dorsal, separated by the projecting dorsal angle of the connective, the thecae of adjacent stamens not contiguous, perianth-segments 7–24 .. *Kadsura* § *Sarcocarpon.*

The characteristics of the Schisandraceae as contrasted with those of the Illiciaceae have been discussed in an earlier part of this treatment. The number of genera composing the Schisandraceae, however, is a question upon which universal agreement has by no means been reached. In addition to the basic genera *Schisandra* (1803) (= *Stellandria* [1803]) and *Kadsura* (1810), the following generic names are worthy of serious consideration: *Sphaerostema* (1825), *Sarcocarpon* (1825), *Cosbaea* (1855), and *Maximowiczia* (1856). Whereas the earlier writers on this group usually maintained some of these genera, by common consent all have recently been submerged in *Schisandra* and *Kadsura.* Only Baillon (10) has reduced the group further, submerging *Kadsura* in *Schisandra.*

The traditional division of the group into two genera has been based entirely upon pistillate characters, *Schisandra* having the fruiting torus greatly elongated and *Kadsura* having it remaining short; in the former case the fruiting carpels are scattered upon a long narrow cylindric receptacle, while in the latter they are aggregated into subglobose or ellipsoid heads. This division is by no means superficial, being supported by the shape of the torus in the flower. It is far from correct to imply that the two genera are separable only in fruit; actually the torus of the ♀ flowers differs in shape to a degree which permits the accurate reference of even a young flower to the correct genus. The carpels of *Schisandra* are more stereotyped than those of *Kadsura.* For instance, the pseudostyle in *Schisandra* is never distally expanded into a peltate pseudostigma, as is often the case in *Kadsura,* nor is the distal carpel-wall in *Schisandra* ever thickened to the extreme degree found in some species of *Kadsura.*

On the basis of androecial characters no parallel division into two genera is apparent. As will be discussed below under the genera, there appear to be seven basic types of androecium, four in *Schisandra* and three in *Kadsura.* Unless one knows by experience which type of androecium is invariably associated with which type of gynoecium, specimens cannot be referred to the genus on the basis of ♂ flowers.

In dividing the family the alternatives are as follows: (1) to accept a single genus only, on the grounds that the androecial and gynoecial variations are not strictly parallel; (2) to accept the two traditional genera on the basis of gynoecial characters; or (3) to erect seven genera on the basis of androecial characters. It appears that anatomical characters are not of much assistance in settling this problem, since variation in anatomical details within the family is very limited. To me the traditional maintenance of two genera seems by far the best solution, on the basis of gross morphology. As stated above, this division is based upon obvious and dependable gynoecial characters. Actually, androecial characters are equally dependable if one is acquainted with the scope of variation, and two theoretical phylogenetic series, coinciding with the two major gynoecial variations, can be hypothecated. Further discussion of this will be found under the respective genera.

The above conclusions are perhaps colored by a traditional belief that gynoecial characters are less flexible, in an evolutionary sense, than androecial characters. Possibly one is not correct in assuming that gynoecial evolution in this case pre-

ceded androecial evolution. However, in view of the fact that none of the androecial variations are duplicated in the two genera, it would seem reasonable to suppose that these androecial characters were evolved after the two basic gynoecial patterns were established.

It is probably vain to speculate upon the characters of the primitive Schisandraceae. In their respective genera § *Pleiostema* (of *Schisandra*) and § *Cosbaea* (of *Kadsura*) seem to be the most primitive sections, and their androecia closely approximate one another. It seems fairly certain that the primitive members of the family had this type of androecium, with the stamens free distally but fused proximally into a rather poorly defined or plastic column. Which of the gynoecial types was primitive is less clear, but the extraordinary toral elongation of *Schisandra* is so remarkable that one may suspect the more compactly developing torus of *Kadsura* more closely to approximate the primitive condition.

1. Schisandra

Schisandra Michx. Fl. Bor.-Am. **2**: 218. 1803 (March); Willd. Sp. Pl. **4**: 372. 1805; Poir. Encyc. Méth. Bot. **6**: 729. 1805; Pers. Syn. Pl. **2**: 558. 1807; Aiton f. Hort. Kew. ed. 2. **5**: 268. 1813; Nutt. Gen. N. Am. Pl. **2**: 209. 1818; Spreng. Anl. Kenntn. Gew. **2**: 677. 1818; K. Koch, Dendr. **1**: 385. 1869; Pfeiffer, Nom. Bot. **2**: 1074. 1874; Lauche, Deutsche Dendr. 359. 1880; Dippel, Handb. Laubholzk. **3**: 156. 1893; Schneid. Ill. Handb. Laubholzk. **1**: 340. 1905; Rehder, Man. Cult. Trees and Shrubs 259. 1927, ed. 2. 253. 1940; Cheng in Contr. Biol. Lab. Sci. Soc. China **9**: 283. 1934; Rehder in Jour. Arnold Arb. **25**: 131. 1944, NOMEN GENERICUM CONSERVANDUM PROPOSITUM.

Stellandria Brickell in Med. Repos. New York **6** (no. 3): 327. 1803 (end Feb. or early March).

Schizandra Michx. ex Desf. Hist. Arb. Arbriss. **2**: 24. 1809; DC. Reg. Veg. Syst. Nat. **1**: 544. 1817, Prodr. **1**: 104. 1824; Reichenb. Consp. 86. 1828; Guillem. in Dict. Class. Hist. Nat. **15**: 239. 1829; Spreng. Gen. Pl. **1**: 239. 1830; G. Don, Gen. Syst. **1**: 101. 1831; Meisn. Pl. Vasc. Gen. 5. 1836, pars alt. 7. 1843; Loudon, Arb. et Frut. Brit. **1**: 295. 1838; Torr. & Gray, Fl. N. Am. **1**: 46. 1838; Endl. Gen. Pl. 836. 1839; Spach, Hist. Nat. Veg. **8**: 10. 1839; Dietr. Syn. Pl. **1**: 590. 1839; A. Juss. in Orbigny, Dict. Univ. Hist. Nat. **11**: 416. 1848; A. Gray, Gen. Pl. U. S. **1**: 57. 1849; Darby, Bot. Southern States **2**: 213. 1855; Chapman, Fl. Southern U. S. 13. 1860; Benth. & Hook. f. Gen. Pl. **1**: 19. 1862; Baill. Hist. Pl. **1**: 146, 189. 1868–69; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 44. 1872; Pfeiffer, Nom. Bot. **2**: 1077. 1874; Nichols. Ill. Dict. Gard. **3**: 383. 1887; Prantl in E. & P. Nat. Pfl. III. **2**: 18. 1888; Boerlage, Handl. Fl. Ned. Ind. **1**: 11. 1890; King in Ann. Bot. Gard. Calcutta **3**: 219. 1891; Koehne, Deutsche Dendrol. 147. 1893; A. Gray, Syn. Fl. N. Am. **1**: 58. 1895; Parment. in Bull. Sci. Fr. & Belg. **27**: 233. 1896; Harms in E. & P. Nat. Pfl. Nachtr. **1**: 158. 1897; Diels in Bot. Jahrb. **29**: 322. 1900; Kanj. For. Fl. School Circ. N.-W. P. 14. 1901; Rehder in Bailey, Cycl. Am. Hort. **4**: 1625. 1902; Small, Fl. Southeastern U. S. 450. 1903; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 48. 1905 [repr. Contr. Fl. As. Or. **2**: 48. 1907]; Brandis, Indian Trees 9. 1906; Finet & Gagnep. in Lecomte, Fl. Gén. Indo-Chine **1**: 39. 1907; Nakai in Jour. Coll. Sci. Tokyo **26**: 38. 1909; Kanj. For. Fl. Siwalik and Jaunsar For. Div. 33. 1911; Koorders, Exkursionsfl. Java **2**: 242. 1912; Bean, Trees and Shrubs Brit. Isles **2**: 503. 1914; Rehder in Bailey, Stand. Cycl. Hort. **6**: 3110. 1917; Leray in Rev. Hort. **97**: 449. 1925; Osmaston, For. Fl. Kumaon 8. 1927; Nakai, Fl. Sylv. Koreana **20**: 100. 1933; Kanj., Kanj., & Das, Fl. Assam **1**: 27. 1935; Burkill, Dict. Econ. Prod. Mal. Penins. 1975. 1935; Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1**: 55. 1938.

Sphaerostema Bl. Bijdr. Fl. Ned. Ind. 22. 1825; Spreng. Syst. Veg. **4** (2): 247. 1827; Bl. Fl. Jav. [Schizandr.] 13. 1830; Spreng. Gen. Pl. **2**: 563. 1831; Hassk. Cat. Pl. Hort. Bot. Bog. 177. 1844; Hook. f. & Thoms. Fl. Ind. **1**: 84. 1855; Drury, Hand-book Ind. Fl. **1**: 648. 1864.

Sphaerostemma Bl. ex Reichenb. Consp. 86. 1828; G. Don, Gen. Syst. **1**: 101. 1831; Meisn. Pl. Vasc. Gen. 5. 1836, pars alt. 7. 1843; Endl. Gen. Pl. 836. 1839; Miq. Fl. Ned. Ind. **1** (2): 19. 1858.

Maximowiczia Rupr. in Bull. Phys.-Math. Acad. Sci. St. Pétersb. **15:** 142. *pl. 1* (as *Maximowitschia*). 1856, in Maxim. in Mél. Biol. **2:** 439. *pl. 1* (as *Maximowitschia*). 1856; Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Etrang. **9:** 31. 1859.

Maximovitzia Rupr. ex Baill. Hist. Pl. **1:** 148, as synonym. 1868–69.

Dioecious or monoecious, often glabrous throughout, the branchlets terete or striate or angled, occasionally winged, the young ones often modified into cicatricose spur-like short shoots, sometimes elongate, the bud-scales usually papyraceous; leaves alternate on long shoots or congested on short shoots, 2–15 (–20) per annual shoot, the petioles often striate or rugulose when dried, shallowly canaliculate, the blades often succulent when fresh, drying submembranaceous to papyraceous or chartaceous, sometimes glaucous beneath, pinnate-veined, usually decurrent on the petiole, acute to acuminate at apex, usually denticulate or sinuate-denticulate at margin with callose-apiculate teeth, rarely entire, the venation usually obvious, not immersed; flowers solitary in axils of fugacious bracts or foliage leaves near base of annual shoots (in § *Sphaerostema* sometimes paired, occasionally aggregated in clusters of 3–8), sometimes subtended by 1 to few minute evanescent secondary bracts, pedicellate; pedicels slender, terete, gradually enlarged distally, ebracteolate or unibracteolate (in § *Sphaerostema* 1–4-bracteolate); perianth-segments usually 2- or 3-seriate, 5–20 in number, all essentially similar or frequently the outermost and innermost ones reduced or modified in texture, membranaceous to subcarnose, often scariose-margined, often pellucid-glandular, elliptic to suborbicular or obovate, flabellate-nerved, often inconspicuously so; androecium various in the different sections, composed of few to many (4–60) stamens, variously aggregated; stamens in § *Pleiostema* comparatively numerous, free on a column or the distal ones fused into a peltate mass, in § *Maximowiczia* few (4–6), sessile at apex of a slender terete stalk, in § *Euschisandra* 5, rotate, fused in a flattened pentagonal mass, in § *Sphaerostema* 5–16, impressed in cavities on the surface of a subglobose mass; stamens with extrorse to lateral or introrse thecae; gynoecium composed of a column and numerous (12–120) few- to many-seriate carpels, the column cylindric to conical, terete, distinctly longer than broad, the carpels attached to the column by a frequently narrowed base, the ovary ovoid-ellipsoid to obovoid, often subfalcate, the wall carnose, uniform in thickness or slightly thicker distally, the stigmatic crests distally produced into a pseudostyle, this flattened or subulate or conical, sometimes lacking, the stigmatic crests proximally extended into 1–3 irregularly oblong appendages often reaching base of ovary, the ovules 2 (rarely 3 in § *Euschisandra*), superposed or obliquely superposed, ventrally attached; fruit with a greatly elongate torus, the pedicel remaining slender, sometimes slightly elongating; fruiting torus greatly modified and elongated, slender or stout, subcylindric or lightly angled, bearing the carpels spaced or crowded on its surface; carpels in fruit usually ellipsoid to obovoid, rounded or narrowed and pseudostipitate at base, rounded at apex or obscurely apiculate with the remnant of the pseudostyle, the pericarp carnose or thin-carnose, uniform in thickness, often immersed-glandular, the stigmatic crests subpersistent or usually obscure; seeds 2, superposed (rarely reduced to 1, possibly sometimes 3 in § *Euschisandra*), ellipsoid to subglobose or reniform, with a lateral hilar indentation, this usually inconspicuous or sometimes essentially none, the testa castaneous, hard, smooth to rugulose or conspicuously tuberculate.

TYPE SPECIES: *Schisandra coccinea* Michx., dating from the same place as the generic description, and in the present treatment referred to the synonymy of *S. glabra* (Brickell) Rehder.

DISTRIBUTION: Eastern Asia (Amur River region and southern Sakhalin southward to Formosa, northern Indo-China, and Himalayan India, with two species in Java and Sumatra) and southeastern United States (one species in coastal plain and Mississippi embayment). See maps, *figs. 2* and *15*. Twenty-five species are recognized in this treatment.

SYNONYMY: *Schisandra* Michx. and *Stellandria* Brickell, both published in the early part of 1803 and both based upon the same American species, are identical concepts. *Stellandria* has been nearly completely overlooked, but Rehder (33) points out, with apparent correctness, that it probably has priority of some weeks over *Schisandra*. Michaux's generic name, for the several reasons indicated by Rehder, should by all means be conserved over *Stellandria*, and in this paper I proceed on the assumption that such conservation by the next International Botanical Congress will be unquestioned. Michaux's widely used binomial *Schisandra coccinea*, however, is to be replaced by *S. glabra* (Brickell) Rehder. Occasionally in the literature the generic name *Schisandra* is accredited to "L. C. Rich. ex Michx." In the original publication there is no indication that Michaux wished to credit the name to Richard, and I have not been able to learn the source of this reference.

Sphaerostema Bl., published in 1825 and based upon two Javanese species, has by most recent students been considered a synonym of *Schisandra*. Although neither of Blume's species falls into *Schisandra* in its limited sense (§ *Euschisandra*), both species are included in *Schisandra* as I interpret the genus, one in § *Pleiostema* and one in § *Sphaerostema*. A discussion of the typification of Blume's genus (and consequently of § *Sphaerostema*) will be found below.

Maximowiczia Rupr., published in 1856 and based upon the single species *M. amurensis* Rupr., is similarly distinct from *Schisandra* in its limited sense, but practically all recent authors have taken *Schisandra* to include Ruprecht's concept. With this point of view I agree, and below I maintain the concept as § *Maximowiczia*, with a single species, *Schisandra chinensis* (Turcz.) Baill.

ORTHOGRAPHY: Rehder (33: 130) has adequately discussed the misspelling *Schizandra*, first used by Desfontaines in 1809 and subsequently given currency by de Candolle in 1817 and 1824. Most writers have used this spelling, but Michaux clearly indicated the origin of his generic name as "Σχισις, Ανηρ: *fissurae* antheris interjectae." The first part of the compound name is not derived from σχιζειν, and consequently the later spelling *Schizandra* is to be rejected. In the present paper I have recorded in the synonymy of each species the spelling of the generic name as published.

Blume's generic name *Sphaerostema* has similarly been subjected to orthographic vicissitudes, although Blume (13) explained its derivation as from "σφαῖρα globus et στῆμα stamen, alludentes staminibus in massam globosam concretis." The spelling *Sphaerostemma*, first used by Reichenbach in 1828 and subsequently taken up by many authors, is therefore incorrect. In the synonymies below I have recorded the spelling as variously used.

Nor has the remaining synonym, *Maximowiczia*, escaped orthographic mistreatment. In various binomials, one finds the spellings *Maximowitschia* and *Maximovitzia*, as recorded below in my synonymy of *Schisandra chinensis*.

The synonymy of the various species of *Schisandra*, complicated enough by normally diverse interpretations and identifications, has been made even more unwieldy by these generic orthographic variants. However, it has seemed advisable to record them as faithfully as possible, in order that future students of the group may be spared consideration of such a petty nomenclatural problem.

CRITERIA FOR DELIMITATION OF SECTIONS; THEORETICAL PHYLOGENY. In habit, the various species of *Schisandra* are fundamentally similar, with minor modifications in foliage, degree of development of short shoots, etc. In arrangement of flowers, § *Sphaerostema* differs somewhat from the other three sections, which have the flowers solitary, either in the axils of foliage leaves or in the axils of fugacious bracts toward the base of annual shoots. In § *Sphaerostema* the flowers may be either solitary or paired or sometimes aggregated into irregular branching axillary inflorescences of 3–8 flowers. This difference does not appear very fundamental, as these axillary "inflorescences" probably result merely from the occasional branching of the annual shoot in § *Sphaerostema*, whereas normally in *Schisandra* such shoots are simple. Fundamentally, the inflorescence of *Schisandra* is similar to that of *Euptelea* and *Drimys*. Dioeciousness appears to be the rule in *Schisandra*, but in certain species monoeciousness is prevalent.

The ♀ flowers throughout *Schisandra* are so similar in basic characters that they do not offer sectional criteria. The minor modifications pertaining to num-

ber of carpels, distal prolongation of the stigmatic crests, etc., are sometimes of specific value.

The fruits also are essentially similar throughout and cannot be extensively used in delimiting sections. Whether the seeds are smooth or to a certain degree rugulose or tuberculate has specific significance, but in separating sections it is of only partial value as follows:

§ *Maximowiczia* and § *Sphaerostema:* seeds always smooth.
§ *Euschisandra:* seeds always rugulose to tuberculate.
§ *Pleiostema:* seeds in different species varying from smooth to rugulose or tuberculate.

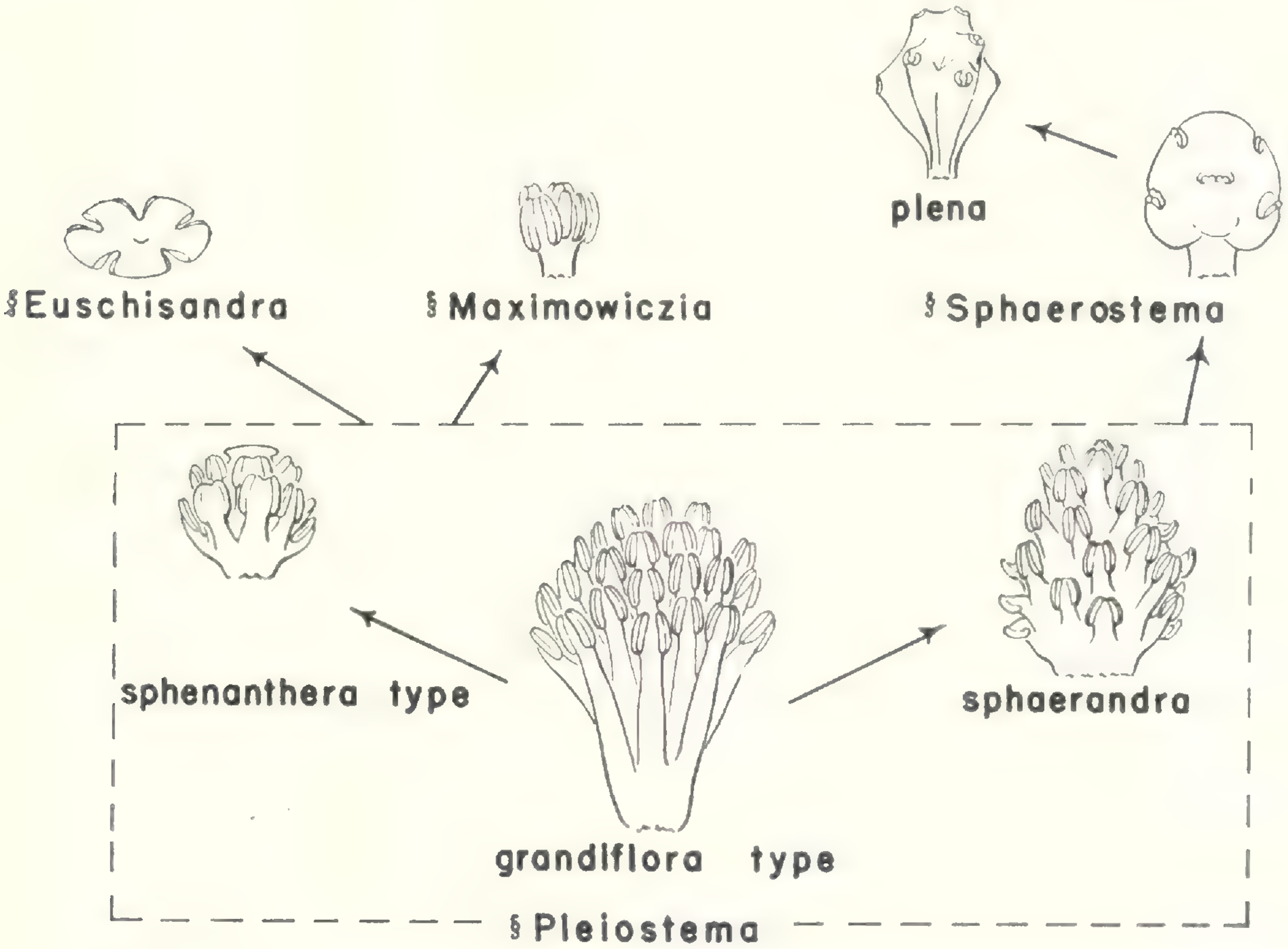

FIG. 14. Theoretical phylogeny of the sections of *Schisandra* based on androecial characters; for explanation see text. All figures × 3.

It is perhaps of significance that the seed character is variable in § *Pleiostema,* which, as will be indicated below, seems the primitive section on the basis of androecial characters, while the seeds of the other sections are fixed in the character of their surfaces.

From the foregoing it may be observed that the phylogeny of the sections of *Schisandra,* if to be correlated at all with reproductive features, must be hypothecated upon androecial characters. On this basis it appears that § *Pleiostema* is the primitive section. The species of § *Pleiostema* have an androecium composed of few to numerous essentially free stamens, which appear to be arranged in irregular whorls upon a more or less elongated stalk or column. Actually this column is composed of the lower parts of filaments; sometimes it is inconspicuous, and again, as in *S. sphaerandra,* it is somewhat conical and obvious; usually it can be torn apart and the identity of the composing filaments observed. In some species of § *Pleiostema* the distal stamens tend to be fused into an irregular ter-

minal shield, the borders of which are partially theciferous. The presence of a distal shield is usually prevalent in the species with comparatively few stamens; the species with numerous stamens, like *S. grandiflora* and its allies, usually have all the stamens free, although the distal ones may be reduced in size.

The number of stamens in § *Pleiostema* varies from 8 to 60, but this figure refers to the free stamens, exclusive of those few which are fused into a terminal androecial shield and therefore without individuality. The thecae vary from extrorse to introrse-lateral; only four species have the thecae extrorse (or extrorse-lateral), and these are species with a prevailingly large number of stamens, namely *S. grandiflora*, *S. rubriflora*, *S. incarnata*, and *S. sphaerandra*. I visualize the first three of these as the most primitive extant species of *Schisandra* on the basis of androecial characters, a hypothesis which receives some support from pollen studies which will subsequently be reported upon by my colleagues Prof. Bailey and Dr. Nast.

From § *Pleiostema*, one trend leads toward a reduction in number of stamens to 4 or 5 (rarely 6), the anthers remaining free. This situation occurs in § *Maximowiczia*, where the filaments are completely fused into a short column bearing the few sessile and extrorse-laterally dehiscing anthers at its apex. In § *Pleiostema* the existence of such a well defined column is suggested, although imperfectly, in such species as *S. sphenanthera* and its allies, where the lower part of the androecium is free of anthers. The derivation of § *Maximowiczia* with its single species, *S. chinensis*, from § *Pleiostema* is thus readily visualized as the result of extreme androecial reduction. The fact that the anthers of § *Maximowiczia* have essentially extrorse dehiscence should be noted, as in this respect the section shows a closer relationship to the supposedly "primitive" species of § *Pleiostema* than to the more "advanced" species such as *S. sphenanthera*.

Another androecial trend is seen in § *Euschisandra*, with three species. In this section the androecium is highly stereotyped and not variable, consisting of a flattened pentagonal shield composed of 5 radiating anthers which bear thecae on their lower (morphologically dorsal) margins. It is possible to trace this type of androecium from that of § *Pleiostema* by visualizing a pronounced shortening of the column, a reduction in the number of stamens, and a tendency of the anthers to fuse. This type of androecium is presumably one of the end-products in the genus.

A fourth androecial type in *Schisandra* is seen in § *Sphaerostema*, where the androecium consists of a subglobose or ellipsoid carnose mass (presumably composed of fused filaments but so modified that all trace of individuality has been lost), on the surface of which the anthers are borne. At first, in their ontogeny, the anthers are appressed into minute cavities on the face of the androecial mass, but at length they draw away from the mass and stand out on minute stipes. In *S. plena*, an extreme form probably representing the culmination of this type of specialization, the anthers remain permanently immersed in the tissue of the androecial mass, being sessile on the outer wall of the circular cavities. The anthers in § *Sphaerostema*, as far as observed, are 6–15 in number and have introrse thecae. It is possible to visualize the derivation of the § *Sphaerostema* type of androecium from the § *Pleiostema* type. For instance, such a species as *S. sphaerandra* (§ *Pleiostema*) has the anthers subsessile on a rather enlarged subconical column, which is doubtless filamentous in origin. Except for the enlargement of the column and a concomitant shortening of the free parts of the filaments, the androecium of *S. sphaerandra* is essentially similar to that of *S.*

grandiflora, a hypothetically "primitive" species. To visualize the condition found in § *Sphaerostema,* it is necessary only to imagine a continuation of this trend until the carnose column becomes the great bulk of the androecium and the anthers are appressed into it (or even engulfed by it, as in *S. plena*) ; the anthers of § *Sphaerostema* agree in their introrse dehiscence with those of most species of § *Pleiostema.*

The type of androecium seen in § *Sphaerostema* has sometimes been confused by students of the family with the type found in *Kadsura* § *Eukadsura* and § *Sarcocarpon,* where in young stages the stamens are often so closely appressed as to appear connate and the thecae may appear to be partially embedded in an androecial mass. Actually, however, in these sections of *Kadsura* the anthers are entirely free; sometimes (in § *Eukadsura*) they are so closely and so regularly laterally appressed that the thecae of adjacent anthers may be mistaken, on superficial examination, for parts of the same anther. Actually the two component thecae of each anther are far separated by the greatly broadened connective. In § *Sphaerostema* of *Schisandra,* on the other hand, the adjacent thecae are actually component parts of the same anther. The mentioned sections of *Kadsura* and § *Sphaerostema,* although they may appear closely related superficially, probably in actuality represent the most diverse lines of androecial evolution in the family.

CORRELATION OF GEOGRAPHICAL DISTRIBUTION WITH THEORETICAL PHYLOGENY: In general terms, the distribution of the four sections of *Schisandra* is as follows:

§ *Pleiostema.* Central China, Himalayan India, and Formosa southward to Java (but not known from intermediate parts of Malaysia south of northern Indo-China).

§ *Maximowiczia.* Amur River region and Sakhalin southward to northeastern China, Korea, and Honshu.

§ *Euschisandra.* Southern Japan (Honshu, Shikoku, Kyushu), southern Korea, and Chekiang in eastern China; also in southeastern United States.

§ *Sphaerostema.* Southwestern China and Himalayan India southward to Sumatra and Java (but not known from intermediate parts of Malaysia south of central Burma).

It may be taken for granted that the center of origin of the genus was Asiatic for the following primary reasons: (1) All four sections occur in Asia and only one in America; furthermore, this American section (§ *Euschisandra*) is highly specialized as to its androecial type, and it would seem impossible to hypothecate the derivation of the rest of the genus from it. (2) The closely related genus *Kadsura* is entirely Asiatic, with no American representative. These two genera, beyond doubt, had a common ancestry. (3) The presumably primitive type, § *Pleiostema,* is exclusively Asiatic and in general southern.

The modern distribution and the theoretical phylogeny of androecial types in § *Schisandra* are mutually supporting. Section *Pleiostema* is subtropical in distribution; § *Maximowiczia* and § *Euschisandra* are comparatively north temperate. It is probable that the northern climate was correlated with the androecial reduction found in the two latter sections. Section *Sphaerostema* has essentially the range of § *Pleiostema* but is more restricted; it is inconceivable that such a specialized androecial type as that of § *Sphaerostema* could have preceded the more generalized type of § *Pleiostema.*

Assuming the probability (or at least the possibility) that the origin of the genus was somewhere within the modern range of § *Pleiostema,* one may visualize an androecial modification as having taken place in the western part of this range, leading to § *Sphaerostema.* Another modification, primarily a simplification, would have taken place to the north among individuals migrating toward Man-

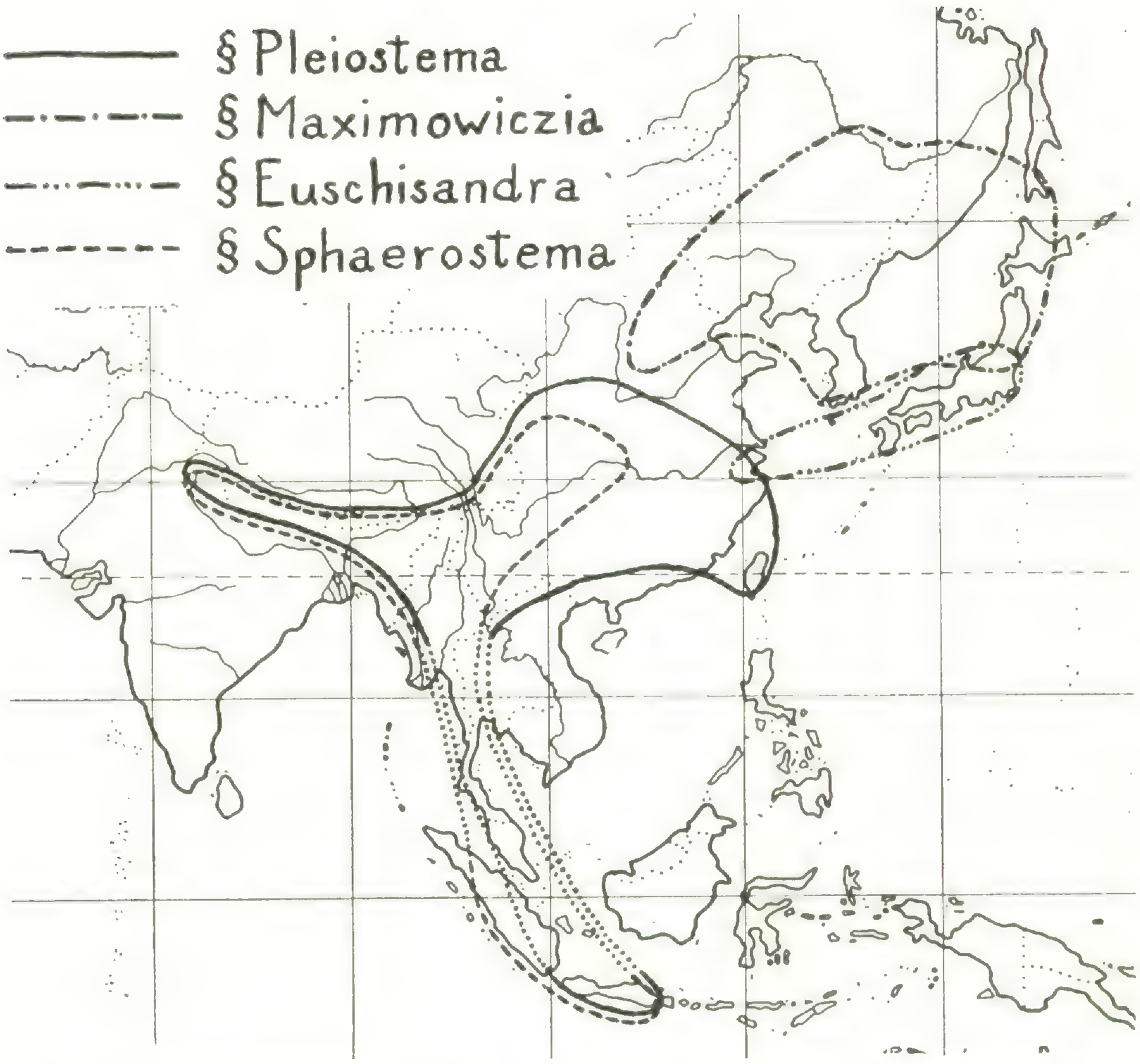

FIG. 15. Generalized distribution of the four sections of *Schisandra* in the Eastern Hemisphere. For distribution of § *Euschisandra* in the Western Hemisphere see *fig. 2.*

churia and the Japanese islands, leading to § *Maximowiczia.* The ultimate geographical migration and an extreme modification of the androecium occur in § *Euschisandra,* which presumably reached America by a northern route.

KEY TO THE SECTIONS

Androecium composed of essentially free stamens, the anthers sessile or stalked, the distal ones sometimes fused into an irregular sterile or partially theciferous shield; flowers solitary in axils of fugacious bracts or foliage leaves; pedicels ebracteolate or unibracteolate; perianth-segments 5–10; carpels 16–120.

Stamens 8–60, 1–7-seriate on the column, the upper stamens sometimes fused, the thecae extrorse to introrse-lateral; perianth-segments 5–10; carpels 16–120; testa smooth to rugulose or conspicuously tuberculate .....§ *Pleiostema.*

Stamens 4 or 5 (rarely 6), the anthers sessile at apex of a slender terete stalk, the thecae extrorse-lateral; perianth-segments 6–8; carpels 17–40; testa smooth..§ *Maximowiczia.*

Androecium composed of a sessile pentagonal greatly flattened shield consisting of 5 radiating stamens, the connectives fused proximally into the shield, the thecae borne on the lower (dorsal) margins of anthers; flowers solitary in axils of fugacious bracts or foliage leaves; pedicels ebracteolate or unibracteolate; perianth-segments 7–13; carpels 12–30; testa minutely or conspicuously rugulose .....§ *Euschisandra.*

Androecium composed of a subglobose or obovoid mass bearing 5–16 stamens in shallow or circular cavities on its surface, the anthers at length free and reflexed or remaining immersed in cavities, the thecae introrse; flowers solitary in axils of foliage leaves or sometimes paired or occasionally aggregated in clusters of 3–8; pedicels 1–4-bracteolate; perianth-segments 6–20; carpels 25–45; testa smooth .....§ *Sphaerostema.*

Section Pleiostema

Schisandra sect. **Pleiostema** sect. nov.

Sectio *Schisandrae* maxima; floribus basim ramulorum hornotinorum versus axillaribus vel in axillis bractearum fugacium enatis solitariis; pedicellis ebracteolatis vel unibracteolatis; segmentis perianthii 5–10; androecio ovoideo vel subgloboso vel obovoideo, columna carnosa subconica vel subclavata staminibusque 8–60 et 1–7-seriatis composito, staminibus superioribus in massam carnosam peltatam interdum marginibus imperfecte theciferam saepe coadnatis, staminibus interdum omnino liberis, filamentis liberis subteretibus vel ligulatis saepe glandulosis, connectivo carnoso complanato oblongo vel obovoideo vel subclavato saepe glanduloso thecas subaequante vel excedente vel quam thecis paullo breviore, thecis extrorsis vel lateralibus vel introrso-lateralibus ellipsoideo-oblongis protuberantibus; carpellis paucis vel numerosissimis (16–120); seminium testa levi vel rugulosa vel conspicue tuberculata.

Type species: As type of the new section I herewith designate *S. grandiflora* (Wall.) Hook. f. & Thoms., based on *Kadsura grandiflora* Wall., the oldest binomial referable to the sectional concept.

Distribution: From central China and Formosa westward to Himalayan India, and thence southward to Java, but not known in intervening areas (southern Indo-China, Siam, southern Burma, Malay Peninsula, or Sumatra). See map, *fig. 15.* Eighteen species are recognized in this treatment.

This new section is proposed for those species of *Schisandra* which have the androecium composed of numerous (8–60) essentially free stamens, of which the filaments are fused proximally to varying degrees into a column, but of which the anthers are always free (except in certain species which have the distal anthers fused into a mass and lacking in individuality). The closest relative of § *Pleiostema* is § *Maximowiczia,* in which the androecial stalk is much better defined and the stamens reduced in number. Section *Pleiostema* is the largest section of *Schisandra* and also appears to be the most primitive one, as discussed above under the genus. In describing or discussing species of this relationship, students have either ignored the desirability of a sectional name or (like Stapf in Curtis's Bot. Mag. **152**: *tab. 9146.* 1928) have interpreted § *Sphaerostema* in a too-inclusive sense.

The necessity for a new sectional name for this concept is dictated if one takes as the type of § *Sphaerostema* the binomial *Sphaerostema axillare* Bl., as I have done, for reasons which are detailed below under § *Sphaerostema.* Blume's second species of *Sphaerostema, S. elongatum,* is treated by me as a species of § *Pleiostema.*

The new sectional name is derived from πλείων, more, and στήμων, thread (stamen), alluding to the fact that the stamens are here more numerous than in any of the other three sections. Although it is very distinct from the rest of the genus and is readily recognized, § *Pleiosema* offers great difficulty in drawing specific lines. As usual within the sections of the Schisandraceae, species as sharply delimited entities are exceptional; most species must be defined on the basis of averages and tendencies. Nevertheless the recognition of 18 species in § *Pleiostema* seems, on the whole, conservative. There is no basic cleavage

within the section into two more or less equal parts, but on the other hand a number of species-groups are apparent. Such groups are as follows:

(1) A group with large flowers, the lower stamens clearly stalked, the thecae extrorse-lateral or obviously extrorse, the carpels numerous: *S. grandiflora, S. rubriflora,* and *S. incarnata,* from south-central China to Himalayan India.

(2) A single rather isolated species, *S. sphaerandra,* from Szechuan and Yünnan at fairly high elevations; characterized by having numerous stamens appearing subsessile on an enlarged column, extrorse thecae, and numerous carpels.

(3) A group with large and subpersistent bud-scales, narrowly winged or angled young branchlets, and stamens with large and flattened connectives: *S. Henryi* and *S. perulata,* of China and northern Indo-China. A very reduced form with somewhat similar stamens is *S. gracilis,* of Burma, which however does not have the characteristic bud-scales and branchlets of the *S. Henryi* group.

(4) A group with the leaf-blades puberulent or tomentellous beneath or crispate-pilose at least on the nerves, the flowers generally more or less similar to those of *S. sphenanthera* and its immediate allies: *S. pubescens* and *S. tomentella,* from Hupeh and Szechuan. Although this species-group is artificial, being based upon characters of foliage which presumably are not fundamental, it is nevertheless readily recognized.

(5) A group with the flowers greatly reduced both in size and in number of parts: *S. lancifolia* and *S. micrantha,* from Szechuan to Yünnan.

(6) The remaining species, characterized by having flowers of moderate size, stamens appearing sessile or subsessile on the column, an intermediate number of floral parts, and glabrous foliage. Within this group certain peripheral species are fairly well marked, e. g. *S. elongata* (Java), *S. Wilsoniana* (Yünnan), and *S. gracilis* (Burma). The remaining five species, *S. glaucescens, S. sphenanthera, S. neglecta, S. viridis,* and *S. arisanensis,* form a complex ranging from Himalayan India across China to Formosa. Each species, as here recognized, has a fairly coherent and limited distribution, and characters are such that each entity can with reasonable ease be separated from any other entity. Nevertheless, a satisfactory key to this group can hardly be constructed at present, and in making identifications one is advised to rely upon herbarium comparison and geographical distribution.

Section Maximowiczia

Schisandra sect. **Maximowiczia** (Rupr.) Nakai, Fl. Sylv. Koreana **20:** 101 (as *Schizandra* sect. *M.*). 1933.

Maximowiczia Rupr. in Bull. Phys.-Math. Acad. Sci. St. Pétersb. **15:** 142. 1856.

Flowers solitary in axils of fugacious bracts toward base of annual shoots; pedicels ebracteolate or unibracteolate; perianth-segments 6–8; androecium composed of a soft-carnose stalk and 4 or 5 (rarely 6) anthers, these erect or suberect, sessile, one rarely modified into a subulate sterile or semisterile appendage, the connective soft-carnose, subterete or slightly flattened, obtuse, usually slightly exceeding the thecae in length, the thecae extrorse-lateral, linear-oblong, parallel; carpels 17–40; testa of seeds castaneous, smooth.

Type species: The sole basis of Ruprecht's genus is *Maximowiczia amurensis* (1856), a synonym of *Schisandra chinensis* (Turcz.) Baill., based on *Kadsura chinensis* Turcz. (1837).

Distribution: Amur River region and Sakhalin southward to northeastern China, Korea, and Honshu. See map, *fig. 15.* The section is composed of only one species.

Synonymy: The sectional name was proposed by Nakai in a key, but the proposal seems perfectly adequate and the name obviously refers to Ruprecht's genus.

The relationships of § *Maximowiczia* are obviously primarily with § *Pleiostema,* and, as discussed elsewhere in this treatment, the northern section of the two seems to have been derived by androecial reduction from the southern. On the basis of available material and records, the modern distributions of these two sections are discrete.

Section Euschisandra

Schisandra sect. **Euschisandra** Nakai, Fl. Sylv. Koreana **20:** 101 (as *Schizandra* sect. *Eu-Schizandra*). 1933.

Schisandra Michx. Fl. Bor.-Am. **2:** 218, sens. str. 1803.

Schizandra (*Euschizandra*) Baill. Hist. Pl. **1:** 189. 1868–69.

Flowers solitary in axils of fugacious bracts or foliage leaves toward base of annual shoots; pedicels ebracteolate or unibracteolate; perianth-segments 7–13; androecium carnose, flattened, pulvinate, pentagonal, faintly depressed at center, composed of 5 fused stamens which are free distally, the anthers rotate, obdeltoid, the connective carnose, truncate or faintly rounded at apex and slightly exceeding the thecae in length, the thecae ellipsoid, borne on the lower (morphologically dorsal) margins of the connective, protuberant; carpels 12–30; testa of seeds castaneous, minutely or conspicuously rugulose.

Type species: The basis of the section is *Schisandra coccinea* Michx. (1803), a synonym of *S. glabra* (Brickell) Rehder, based on *Stellandria glabra* Brickell (1803).

Distribution: Southern Japan (Honshu, Shikoku, and Kyushu), southern Korea, and Chekiang in eastern China; also in southeastern United States. See maps, *figs. 2* and *15.* Three species are here recognized.

Synonymy: Baillon's parenthetical use of the name *Euschizandra,* cited above, does not in my opinion establish the section nomenclaturally. Baillon, in reducing *Kadsura* to *Schisandra,* merely remarked: "receptaculo communi demum, aut brevi capitato (*Kadsura*), aut valde elongato spiciformi (*Euschizandra*); . . ." Nakai's use of the sectional name is supported by an adequate description in a key; he apparently thought of this typical section as composed exclusively of the American species, for he erroneously refers *S. nigra* (*S. repanda* in my treatment) to § *Maximowiczia.* I have altered Nakai's spelling in accord with the conclusions expressed in an earlier section of this paper, in my discussion of the orthography of Michaux's generic name.

In its geographical distribution, § *Euschisandra* has the widest range of any section of the genus; students of boreal distributions may note the striking similarity of the American *S. glabra,* in all fundamental characters, to its immediate Asiatic allies. The three species of § *Euschisandra* are so similar, in characters pertaining to the perianth-segments, androecium, and gynoecium, that these organs offer nothing dependable for specific recognition, the number of parts being of only secondary importance. However, the foliage of the American and the Asiatic representatives is different, and the seeds of the Asiatic species (at least of *S. repanda*) are much more conspicuously rugulose or essentially tuberculate.

Section Sphaerostema

Schisandra sect. **Sphaerostema** (Bl.) Nakai, Fl. Sylv. Koreana **20:** 101 (as *Schizandra* sect. *S.*). 1933.

Sphaerostema Bl. Bijdr. Fl. Ned. Ind. 22, quoad *S. axillare.* 1825.

Schizandra sect. *Sphaerostemma* Stapf in Curtis's Bot. Mag. **152:** sub *tab. 9146,* nomen. 1928.

Flowers in axils of fugacious bracts or foliage leaves, solitary or sometimes paired, occasionally in clusters of 3–5 or aggregated in congested branching axillary inflorescences of 3–8; pedicels with 1–4 bracteoles; perianth-segments 6–20; androecium subglobose or obovoid, composed of a subcoriaceous or carnose mass bearing 5–16 stamens in shallow or circular cavities on its surface, the stamens

at length free and reflexed or remaining immersed in cavities, the anthers sessile, the connective subcarnose, deltoid, truncate or obtuse at apex and subequal to thecae (sometimes free connective lacking, the thecae sessile in anther-cavities), the thecae introrse, parallel; carpels 25–45; testa of seeds castaneous, smooth.

TYPE SPECIES: *Sphaerostema* Bl. is based on *S. axillare* Bl. and *S. elongatum* Bl., published simultaneously without designation of a genotype. For reasons to be amplified below, I designate *Sphaerostema axillare* as the type of Blume's genus and consequently of the section; this binomial is referable to *Schisandra axillaris* (Bl.) Hook. f. & Thoms.

DISTRIBUTION: Southwestern China and Himalayan India southward to Sumatra and Java, but not known in intervening areas (Siam, southern Burma, or Malay Peninsula). See map, *fig. 15.* Three species are recognized as making up this section.

SYNONYMY: *Sphaerostema* Bl. was originally (12) based on two species, *S. "axillaris"* and *S. "elongata,"* without indication of a genotype. The original descriptions were not very ample but later were well extended by Blume (13) and illustrated. Thus, in the original description of *S. axillaris* Blume says, "filamentis exterioribus liberis," of *S. elongata,* "filamentis omnibus connatis." In 1830 he says of *S. axillare* [note correct gender]: "*Stamina* omnia . . . in globum carnosum . . . cavitatibus circa 15 parvis triangulis tessellatim dispositis alveolatum et ad has infra gibbosum."; also: "staminibus omnibus connatis . . . (*attamen character reform.*)." Thus it is obvious that Blume changed his mind about the "free" stamens of *S. axillare* when he came to amplify the original description. His drawing of a longitudinal section of the androecium shows the type found in the continental *S. propinqua.*

The revised description of the androecium of *S. elongatum* [note correct gender] says: "stamina . . . superiora in massam hemisphaericam coadunata, inferiora libera, brevissima, crassa, subtruncata. *Antherarum loculi* extrinsecus secus longitudinem adnati, disjuncti." This also contradicts the original statement. These revised statements are correct. The two Javanese species of *Sphaerostema* represent concepts which cannot, in my opinion, be referred to the same section of *Schisandra.*

It is therefore necessary to indicate a lectotype for the genus *Sphaerostema,* in order properly to transfer the concept to a section of *Schisandra.* Blume's "Observatio" (13: 14) is important in this respect, for here he lists five species of *Sphaerostema: axillare, propinquum,* and *pyrifolium,* with anthers parietal in small cavities, and *grandiflorum* and *elongatum,* with stamens more or less distinct. It is thus obvious that Blume understood the two elements in his genus and recognized the androecial differences between his two original species. Since his generic name is derived from "globus" and "stamen," it may be supposed that the androecial type of *S. axillare* was uppermost in his mind. I propose to accept *Sphaerostema axillare* as the lectotype of *Sphaerostema.* Thus, the *S. propinqua* complex falls into § *Sphaerostema* and the large complex which includes *Sphaerostema elongatum* is left without a sectional name; for this I have above proposed § *Pleiostema.*

It should be noted that Stapf (in 1928) was apparently the first to use the sectional name *"Sphaerostemma,"* mentioning it in connection with *Schisandra sphaerandra* (a species which is co-sectional with *Sphaerostema elongatum* but not with *S. axillare*). But Stapf did not discuss the typification of *Sphaerostema* nor give a description of the section, and therefore his sectional name may be considered a *nomen nudum.*

Nakai's use of the sectional name is in a key and is accompanied by a brief description, but he too failed to indicate a lectotype for Blume's genus and delimited the section only by implication. However, I consider his publication of the section to be valid.

The interpretations of *Sphaerostema,* in the publications of Blume and as reduced to a section by Stapf and Nakai, are here discussed at some length in order to ascertain to which of two well marked sections of *Schisandra* it is applicable. The uses of the sectional name by Stapf and Nakai are too ill-defined to be considered limiting. Since there is no clear precedent, therefore, I feel at liberty to select *Sphaerostema axillare* as the lectotype of Blume's genus and to apply the sectional name in that sense, leaving *Sphaerostema elongatum* and its allies to receive the newly proposed name § *Pleiostema.*

Although the individuals of § *Sphaerostema* are at once distinguished from those of other *Schisandrae* by the unique development of the androecium, they are difficult to group into satisfactory species. This situation appears to be of common occurrence in the Schisandraceae, where the sections are clearly and often spectacularly distinct, while the species are poorly defined.

Within § *Sphaerostema*, the most sharply marked population is represented by the specimens which I describe below as *Schisandra plena*. This species is doubtless a close relative of *S. propinqua*, but it is at once distinguished not only by characters pertaining to foliage, but also by its numerous perianth-segments and its modified androecium. In the other species of § *Sphaerostema* the stamens draw away from the androecial mass at maturity, the thecae being supported on distinct but minute connectives; in *S. plena* the thecae remain immersed in the circular anther-cavities, in which they are sessile on the outer wall, the connective thus not being free. *Schisandra plena* probably shows the most extreme type of stamen-fusion to be found in the family.

Except for this distinct entity, considerable difficulty is found in separating the Malaysian element of § *Sphaerostema* from the large Chinese-Indian element, in spite of the fact that no authentic records of the group are found from the intervening regions. In many works on the Himalayan flora both *Schisandra propinqua* and *S. axillaris* are accredited to that region, and the two species are certainly separable with difficulty on the basis of the inadequate material usually at hand. However, I believe the best disposition to be the reference of all the Indian material to *S. propinqua*, leaving *S. axillaris* limited to Sumatra and Java, as far as available records show. In addition to having its leaf-blades usually toothed (although rarely subentire), *S. propinqua* has its pedicels averaging longer and its perianth-segments averaging more numerous than does *S. axillaris*. At present I have available only four specimens of § *Sphaerostema* from Sumatra and Java (most of the Malaysian herbarium material identified as *S. axillaris* being referable to *Kadsura*); it is hoped that ample material will disclose more reliable points of difference between this entity and the continental *S. propinqua*.

Keys to the species

§ Pleiostema

Androecium with spreading stamens, at least the lower ones with obvious free filaments (1.5–) 2 6 mm. long, the thecae extrorse-lateral or obviously extrorse; perianth-segments large, the largest ones in each flower at anthesis 10–18 mm. long and 6–14 mm. broad; carpels numerous, 60–120; testa smooth or perhaps faintly undulate dorsally.

Leaf-blades prevailingly elliptic to obovate, usually 6–15 cm. long and 2.5–7 cm. broad; lower stamens with obvious free filaments; testa smooth or essentially so.

Perianth-segments (and probably androecium) white or waxy-white, drying yellowish or brownish; pedicels of ♂ flowers at anthesis 10–42 mm. long, of ♀ flowers 17–60 mm. long; stamens 33–60; Himalayan India ..... 1. *S. grandiflora.*

Perianth-segments (and probably androecium) red, scarlet, or crimson (outermost sometimes yellowish), remaining obviously reddish in drying; pedicels of ♂ and ♀ flowers at anthesis 20–50 mm. long; stamens 40–60; Szechuan and Sikang to northeastern Assam ..... 2. *S. rubriflora.*

Perianth-segments (and probably androecium) flesh-pink, drying pale brown; pedicels of ♂ and ♀ flowers at anthesis 17–35 mm. long; stamens about 29; Hupeh. 3. *S. incarnata.*

Leaf-blades lanceolate or oblanceolate or narrowly oblong-elliptic, usually 4–11 cm. long and 1.5–4 cm. broad; pedicels short, of ♂ and ♀ flowers at anthesis 8–27 mm. long; perianth-segments red, crimson, or magenta (white to pink in f. *pallida*); stamens 20–50, sessile or subsessile, the outermost ones with free filaments not exceeding 1.5 mm. in length; testa distantly and obscurely rugulose; Szechuan and Yünnan. 4. *S. sphaerandra.*

Androecium with sessile or subsessile stamens, the lower ones with free filaments (if present) rarely approaching 2 mm. in length, the thecae introrse-lateral or lateral (except extrorse-lateral in no. 4); perianth-segments often smaller than in spp. 1–3 but in some spp. essentially as large; carpels comparatively few, rarely as many as 70 (except 70–110 in no. 4, 60-75 in no. 10); testa smooth to rugulose or tuberculate.

Stamens with extrorse-lateral thecae; carpels 70–110; pedicels short, at anthesis 8–27 mm. long; leaf-blades predominantly lanceolate or oblanceolate, usually 4–11 × 1.5–4 cm.; Szechuan and Yünnan .....4. *S. sphaerandra.*

Stamens with introrse-lateral or lateral thecae; carpels rarely exceeding 60 (60–75 in nos. 8 and 10); pedicels usually more than 25 mm. (only rarely less than 20 mm.) long at anthesis.

Bud-scales large (largest ones 8–20 × 5–15 mm.), subpersistent at bases of annual shoots, the young branchlets winged or sharply angled; stamens comparatively large, with flattened connectives usually obviously exceeding the thecae in length.

Flowers comparatively large, the largest perianth-segments 12–15 × 11–13 mm.; outermost stamens 4–5 mm. long, with short free filaments 0.5–1 mm. long and thecae 2.5–3 mm. long; testa very conspicuously verruculose-tuberculate; leaf-blades large (9–18 × 5–11 cm.), concolorous, thin, translucent, the veinlet-reticulation very copious and intricate, branchlets strong verrucose-lenticellate; Indo-China. 5. *S. perulata.*

Flowers averaging smaller, the largest perianth-segments (at least in ♂ flowers) rarely exceeding 13 ×12 mm.; outermost stamens 2–4 mm. long, with thecae 1–2.3 mm. long; testa minutely to conspicuously rugulose but hardly tuberculate; China. 6. *S. Henryi.*

Bud-scales comparatively small (very rarely exceeding 10 × 10 mm.) and usually fugacious, the young branchlets essentially terete; stamens with oblong to obovoid connectives which are subequal to the thecae or only slightly exceeding them (except in no. 16, with comparatively small flowers).

Flowers comparatively large, the largest perianth-segments in each flower (4.5–) 6–14 × 4–14 mm.; free stamens 10–35; carpels 20–75 but rarely fewer than 25; fruit comparatively long, the torus 4–17 cm. (but rarely less than 5 cm.) long.

Leaf-blades puberulent or tomentellous beneath or crispate-pilose at least on the nerves; perianth-segments suborbicular or broadly elliptic, about as broad as long; carpels 45–70 at anthesis.

Pedicels of ♀ flowers 55–90 mm. long; largest perianth-segments (at least ♀) 12–14 × 10–14 mm.; bud-scales large, persistent; leaf-blades pale-puberulent on costa and principal nerves beneath only; Kwangtung. 6c. *S. Henryi* var. *longipes.*

Pedicels of ♀ flowers 20–60 mm. long; largest perianth-segments 4.5–10 × 4–10 mm.; bud-scales small, caducous.

Lower leaf-surfaces puberulent, or crispate-pilose or short-tomentellous on nerves, the hairs simple, 0.1–0.7 mm. long; perianth-segments 7–10; carpels 45–55; Hupeh and Szechuan .....7. *S. pubescens.*

Lower leaf-surfaces copiously brown-tomentellous, the hairs irregularly branched, tangled, 0.5–1 mm. long; perianth-segments 5–7; carpels about 70; Szechuan. 8. *S. tomentella.*

Leaf-blades glabrous.

Stamens with obovoid to oblong connectives which are subequal to thecae or only slightly exceeding them, the thecae sometimes subcontiguous at base.

Perianth-segments 9 or 10, the outermost and innermost ones sharply reduced in size; free stamens 18–25, with all the anthers sessile; carpels 20–25; leaf-blades ovate, often broadly so; Java .....9. *S. elongata.*

Perianth-segments 5–8, usually all essentially similar, the outermost and innermost ones sometimes slightly reduced in size; lowermost anthers with short but usually apparent stipes; carpels 25 or more; continental (and Formosan) species.

Leaf-blades ovate-elliptic, usually 7–12 × 3.5–6 cm., conspicuously glaucous beneath, very obscurely denticulate at the subentire margins; perianth-segments (at least ♀) comparatively large, suborbicular, the largest ones 11–12 × 10–11 mm.; carpels 60–75, with a conspicuous subulate pseudostyle 0.5–0.8 mm. long; Yünnan .....10. *S. Wilsoniana.*

Leaf-blades obviously denticulate at margin; perianth-segments smaller, usually 5–10 (rarely to 13) × 4–10 mm.; carpels rarely exceeding 50 (about 60 in no. 15).

Blades of leaves oblong- to obovate-elliptic, conspicuously glaucous beneath; perianth-segments elliptic to elliptic-oblong, obviously longer than

broad; free stamens 18–25; carpels about 50, the stigmatic crests not extending distally into a pseudostyle; seeds smooth; Hupeh and Szechuan .....11. *S. glaucescens.*

Blades of leaves usually concolorous, sometimes slightly glaucous beneath; carpels usually fewer than 50 (about 60 in no. 15), the stigmatic crests extending distally into an apparent pseudostyle at least 0.1 mm. long.

Leaf-blades elliptic to obovate-elliptic, usually broadest near or above middle, averaging comparatively small (usually 5–11 × 3–7 cm.), often drying brownish, the veinlet-reticulation usually nearly plane and inconspicuous on both surfaces; perianth-segments usually elliptic to oblong-obovate, commonly obviously longer than broad; free stamens 11–19, the thecae often subcontiguous at base; carpels 30–50, terminating in an obscure pseudostyle 0.1–0.2 mm. long; fruiting torus 1–4 mm. in diameter, the testa smooth to rarely rugulose dorsally; central China (Kiangsu to Shansi and Kansu, thence southward to Hunan, Kweichow, and n. e. Yünnan) ..12. *S. sphenanthera.*

Leaf-blades narrowly elliptic to ovate-elliptic, usually broadest below middle (usually 6–12 × 2.5–6.5 cm.), often remaining greenish in drying, the veinlet-reticulation usually prominulous beneath and often so above; perianth-segments broadly elliptic to suborbicular, nearly as broad as long; free stamens 17–35, the thecae often subcontiguous at base; carpels 26–45, terminating in a conspicuous pseudostyle 0.3–0.9 mm. long; fruiting torus slender, 0.8–3 mm. in diameter; the testa obviously rugulose; Yünnan to Himalayan India ....13. *S. neglecta.*

Leaf-blades prevailingly ovate-elliptic, usually broadest below middle (usually 6–14 × 3.5–7 cm.), often remaining greenish or olivaceous in drying, the veinlet-reticulation prominulous on both surfaces, usually obviously so; perianth-segments broadly elliptic to suborbicular, nearly as broad as long; free stamens 10–20, the thecae subparallel; carpels about 25 (as far as known), terminating in an obscure pseudostyle up to 0.2 mm. long; fruiting torus slender, 1–3 mm. in diameter, the testa obviously rugulose to subtuberculate; southeastern China (Anhwei and Chekiang south to Kwangtung, Kwangsi, and Kweichow) .....14. *S. viridis.*

Leaf-blades ovate-lanceolate to oblong-ovate, usually broadest below middle (usually 5–9 × 2–4 cm.), the veinlet-reticulation prominulous on both surfaces; perianth-segments broadly elliptic to obovate, nearly as broad as long; free stamens 18–20, the thecae subcontiguous at base; carpels about 60, with an inconspicuous pseudostyle; testa muricate; Formosa .....15. *S. arisanensis.*

Stamens with large oblong to obovoid flattened connectives which are usually rounded at apex and conspicuously exceeding the thecae in length, the thecae essentially parallel, well separated at base.

Free stamens 10–13; largest perianth-segments 5.5–7.5 mm. long; leaf-blades small, 4–5.5 × 3–4 cm., ovate, obtuse to rounded at base; central Burma. 16. *S. gracilis.*

Free stamens 14–40; largest perianth-segments 6–14 mm. long; leaf-blades comparatively large, usually 7–14 × 3.5–10 cm.; China .....6. *S. Henryi,* vars.

Flowers small, the perianth-segments suborbicular to broadly elliptic, the largest ones 3.5–6 × 2.5–6 mm.; free stamens 8–16; carpels 16–23; fruit comparatively short and slender, the torus 1.5–7 cm. long; leaf-blades comparatively small, not exceeding 10 cm. in length and 6.5 cm. in breadth.

Leaf-blades lanceolate or narrowly elliptic, usually 4–10 × 1–3 cm., acute to attenuate at base; Szechuan, Sikang, and Yünnan .....17. *S. lancifolia.*

Leaf-blades ovate to broadly elliptic, usually 4–7 × 2–6 cm., obtuse to rounded at base; Yünnan .....18. *S. micrantha.*

§ Maximowiczia

One species; northeastern continental and insular Asia .....19. *S. chinensis.*

§ Euschisandra

Young branchlets usually slender and not modified into lateral spur-like short shoots; leaf-blades oblong-elliptic to ovate or lanceolate, often nearly twice as long as broad (usually 6–13 × 3–9 cm.); perianth-segments 9–12; carpels (12–) 20–30; fruiting carpels 5–10 mm. in diameter at maturity, the seeds rugulose but hardly tuberculate; southeastern U. S. ..... *20. S. glabra.*

Branchlets characteristically bearing lateral spur-like short shoots with leaves and flowers distally; leaf-blades broadly ovate to suborbicular or elliptic, nearly as broad as long (usually 4–9 × 3–8 cm.); carpels 12–16; fruiting carpels (at least of no. 21) 8–15 mm. in diameter at maturity, the seeds (at least of no. 21) conspicuously and copiously rugulose-tuberculate; Asiatic species.

Leaf-blades usually 4–8 × 3–6 cm., with 3 or 4 secondary nerves per side; perianth-segments 7–10; Japan and Korea ..... *21. S. repanda.*

Leaf-blades 5.5–9 × 3.5–8 cm., with 4–6 secondary nerves per side; perianth-segments 7–13 (ex char.); Chekiang ..... *22. S. bicolor.*

§ Sphaerostema

Leaf-blades (3–) 5–8.5 cm. broad, entire or remotely denticulate, the veinlet-reticulation very copious and intricate, conspicuously prominulous on both sides; perianth-segments much longer than broad, 11–17 in ♂ flowers, 17–20 in ♀ flowers; stamens 5–8, the anthers sunk in protruding circular cavities, the thecae sessile on the outer wall of the cavity; ♀ flowers subequal to ♂ in size; Yünnan to northeastern Assam ..... *25. S. plena.*

Leaf-blades various but rarely exceeding 5 cm. in width, the veinlet-reticulation less intricate, slightly prominulous to plane; perianth-segments 6–12 in ♂ flowers, 8–16 in ♀ flowers; stamens impressed in cavities only when young, the thecae at length supported by free connectives.

Species of Java and Sumatra; leaf-blades 5–10 × 1.7–4 cm., usually entire, rarely inconspicuously remotely denticulate; pedicels at anthesis 3–12 mm. long; perianth-segments 9–12 in ♂ and up to 14 in ♀ flowers; ♀ flowers subequal to ♂ in size ... *23. S. axillaris.*

Species of China, Burma, and northern India; leaf-blades denticulate or remotely serrulate at margin, occasionally subentire; pedicels at anthesis sometimes up to 26 mm. long but often short, sometimes only 3–5 mm. long; perianth-segments 6–10 in ♂ flowers and 8–16 in ♀ flowers ..... *24. S. propinqua.*

1. **Schisandra** (§ *Pleiostema*) **grandiflora** (Wall.) Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 44, as *Schizandra g.* 1872; Schneid. Ill. Handb. Laubholzk. **1**: 341. 1905, in Bot. Gaz. **63**: 522. 1917; Rehder, Man. Cult. Trees and Shrubs 259. 1927, ed. 2. 254. 1940.

Kadsura grandiflora Wall. Tent. Fl. Napal. 10. *tab. 14.* 1824; G. Don, Gen. Syst. **1**: 102. 1831; Dietr. Syn. Pl. **3**: 307. 1843; Walp. Rep. Bot. Syst. **2**: 15. 1845.

Cadsura grandiflora Wall. ex Spreng. Syst. Veg. **4** (*2*): 345. 1827.

Sphaerostema grandiflorum Bl. Fl. Jav. [Schizandr.] 17. 1830; Wall. Cat. n. 4985. 1832; Loudon, Arb. et Frut. Brit. **1**: 295. 1838; Hook. f. & Thoms. Fl. Ind. **1**: 84. 1855; Walp. Ann. Bot. **4**: 79. 1857.

Schizandra grandiflora Hook. f. & Thoms. ex Brandis, For. Fl. N.-W. and Centr. India 571. 1874; Hemsl. in Garden **8**: 271. 1875; King in Ann. Bot. Gard. Calcutta **3**: 219. *pl. 69, A.* 1891; Kanj. For. Fl. School Circ. N.-W. P. 15. 1901; Collett, Fl. Siml. 16. *fig. 6.* 1902; Brandis, Indian Trees 9. 1906; Kanj. For. Fl. Siwalik and Jaunsar Div. 34. 1911; Rehder in Bailey, Stand. Cycl. Hort. **6**: 3110. 1917; Parker, For. Fl. Punjab 5. 1924; Leray in Rev. Hort. **97**: 449. 1925; Osmaston, For. Fl. Kumaon 8. 1927.

Sph[aerostemma] grandiflora (sic) Bl. ex Parment. in Bull. Sci. Fr. & Belg. **27**: 236. 1896.

Glabrous throughout, apparently dioecious; young branchlets often modified to cicatricose spur-like short shoots, sometimes elongate, the new portions purpurascent or brownish, slightly angled or striate, 1–3 mm. in diameter, the older branchlets often cinereous, subterete or rugulose-striate, 3–7 mm. in diameter; bud-scales papyraceous, oblong, the largest up to 12 × 6 (rarely to 20 × 8) mm., fugacious; leaves 3–9 per annual shoot; petioles 10–25 (–35) mm. long, 0.7–1.5 (–2) mm. in diameter; leaf-blades apparently succulent when fresh, drying char-

taceous to submembranaceous, when dried dark green to brown on both sides or paler to subglaucous beneath, lanceolate or narrowly elliptic to oblanceolate or narrowly obovate, (4–) 7–15 (–17) cm. long, (1.5–) 2.5–6 (–7.5) cm. broad, attenuate or acute or rarely obtuse at base, gradually narrowed distally to a callose-apiculate apex 5–15 mm. long, obscurely denticulate (teeth usually 1–3 per centimeter) or subentire at margin, the costa impressed to slightly prominulous above, raised or prominent beneath, the secondary nerves 5–8 per side, arcuate-ascending, slightly impressed or plane above, slightly or strongly elevated beneath, the veinlet-reticulation plane or slightly impressed above, plane or prominulous beneath; flowers sometimes with 1 or 2 secondary subtending bracts, these papyraceous, minute; ♂ flowers: pedicels slender, 0.5–1.5 mm. in diameter, gradually swollen distally, 10–42 mm. long at anthesis, ebracteolate or rarely obscurely unibracteolate near middle; perianth-segments about 3-seriate, 7 or 8, all essentially similar, when dried membranaceous to papyraceous, inconspicuously nerved, sometimes obviously glandular, broadly elliptic to obovate, the outer 3–5 the largest, 13–18 × 9–14 mm., the inner ones (8–) 11–14 × (3.5–) 6–11 mm.; androecium ovoid, 8–14 × 7–13 mm. including stamens, composed of a subconical column and 33–60 free stamens, these 4–7-seriate, erecto-patent; filaments of lower stamens submembranaceous or thin-carnose, subterete-ligulate, often translucent-glandular, 2–5 mm. long, the uppermost stamens with essentially sessile anthers; connective flattened, subequal to thecae or slightly shorter, the thecae extrorse-lateral, 1.5–3 mm. long (uppermost ones sometimes only 1 mm. long); ♀ flowers: pedicels like the ♂ but 0.7–2 (–3) mm. in diameter and 17–60 mm. long at anthesis; perianth-segments similar to those of ♂ flowers; gynoecium oblong-ellipsoid, at anthesis 6–12 × 5–10 mm. including carpels, the column 2.5–3 mm. in diameter; carpels 70–120, multiseriate, the ovary obovoid, at anthesis 2–2.5 × 1–1.4 mm., the stigmatic crests conspicuous, 0.2–0.5 mm. broad, erosulous at margin, sometimes distally produced into a pseudostyle 0.5–0.7 mm. long, proximally extended into a conspicuous irregular appendage, the ovary-wall thick-carnose distally, thinner proximally; fruiting pedicel often rugulose, usually 1–3 mm. in diameter and 25–80 mm. long at maturity, swollen at apex, the torus stout, 2–6 mm. in diameter, (6–) 15–21 cm. long at full maturity, usually with 30–80 maturing carpels; carpels at maturity well-spaced or crowded, obovoid-ellipsoid, 7–9 × 5–6 mm.; seeds ellipsoid, 3.8–4.2 × 3.2–3.8 × 2–2.5 mm., the hilar indentation inconspicuous, the testa smooth.

TYPE LOCALITY: In his original publication Wallich states: "Observavi frequenter in monte Sheopore Napaliae, nec alibi; . . ." I have not been able to locate this mountain on maps of Nepal, but it is possibly near Sanku (east of Katmandu), a locality mentioned for *Kadsura propinqua* Wall. in addition to the Sheopore locality. No collection number was originally mentioned by Wallich, but in his Catalogue (1832) he cites his no. *4985* as representing the species; this is doubtless to be taken as the type collection and is so cited below.

DISTRIBUTION: Himalayan India, from Bhutan westward to the Simla Hill region of Punjab, at altitudes of 1800–3000 m., usually in mixed woods but also reported from moist fir forests. See map, *fig 16.*

INDIA: BHUTAN: Road to Chuku, *W. Griffith 75* (GH, K); Paro to Bele-La, *B. J. Gould 140* (K); Pumola area, *B. J. Gould 202* (K), *202A* (K); without definite locality, *W. Griffith 1729* (K). BENGAL: Sikkim: Lachen [River?], *J. D. Hooker* in 1849 (K); Sinchal, *J. D. Hooker* (K), *T. Anderson 7* (GH); Keadom, *Ribu & Rhomoo 5604* (US); without definite locality, *J. D. Hooker* (GH, NY); Darjeeling District: Vicinity of Darjeeling, *J. S. Gamble 1888A* (K), *1889A* (K), *8223* (K), *28024* (K), *C. B. Clarke 12217A* (A); "Mirig nangi," *H. H. Haines 794* (K). NEPAL: "Mt. Sheopore," *N. Wallich 4985* (TYPE COLL., GH, K, NY); without definite locality, *N. Wallich* (K, NY). UNITED PROVINCES: Deoban Range, Herb. J. S. Gamble 1013 (K); Lohaghet, *J. Legge 20* (K); Kumaon Division: West Almora, *Bis Ram 2324* (NY); Garhwal, Herb. Falconer 79 (GH, K); Madhuri or Madharee, *R. Strachey & J. E. Winterbottom 1* (or *103*) (GH, K); Tehri: Mt. Kedar Kanta, Herb. J. R. Drummond 14836 (K); Deota, *J. S. Gamble*

23013 (K), *23019* (K), *26742* (K); Dehra Dun District: Chakrata, *B. C. Datta 1* (A); Mussooree, *C. S. Rawat 3* (A), *M. L. Punj 3* (NY); Mundali, *J. S. Gamble 26594* (K), *H. H. Haines 2228* (K), *S. Singh 2* (A), *H. S. Bist 2* (UC), *K. S. Selhi 5* (US). Punjab: Bashahr [or Simla Hill States?]: Bhali, *R. N. Parker 2827* (A, UC), *3032* (A, UC); Gahan, *R. N. Parker 2799* (A, UC); Taprog, *R. N. Parker,* May 1908 (A); Shilla, *R. N. Parker,* May 1908 (A); Simla Hill States: Narkanda, *Madden* (K), *J. F. Duthie 7244* (K), *H. Collett* (K), *J. S. Gamble 6094A* (K); between Matiana and Narkanda, *J. R. Drummond 8327* (K); Matiana, *J. S. Gamble 6035E* (K), *6035F* (K); Mahasu, *H. H. Rich 856* (K); near Simla, Herb. J. R. Drummond 6290 (K); Jubbal, Herb. J. R. Drummond 6288 (K); Paternalla Forest, Bulsun, *H. Collett* (in Herb. Gamble) *5655c* (K); Mt. Chor, Herb. J. R. Drummond 3029 (K). Province?: "Massuri," *T. Thomson* (K); "Hattu," *T. Thomson* Aug. 1847 (K); "Himalaya," *M. P. Edgeworth 54* (K), *H. H. Rich B204* (K); "N. W. India," Herb. Royle (K); "N. W. Himalaya," *D. Brandis,* May 1881 (K), *T. Thomson* (GH); locality illegible, *J. S. Gamble 699A* (K).

CULTIVATED: ? Hort. Vilmorin (A) (Verrières).

Color notes, local names, etc.: The flowers, which are often reported as being very fragrant, have the perianth-segments (and presumably the androecium) white or waxy-white

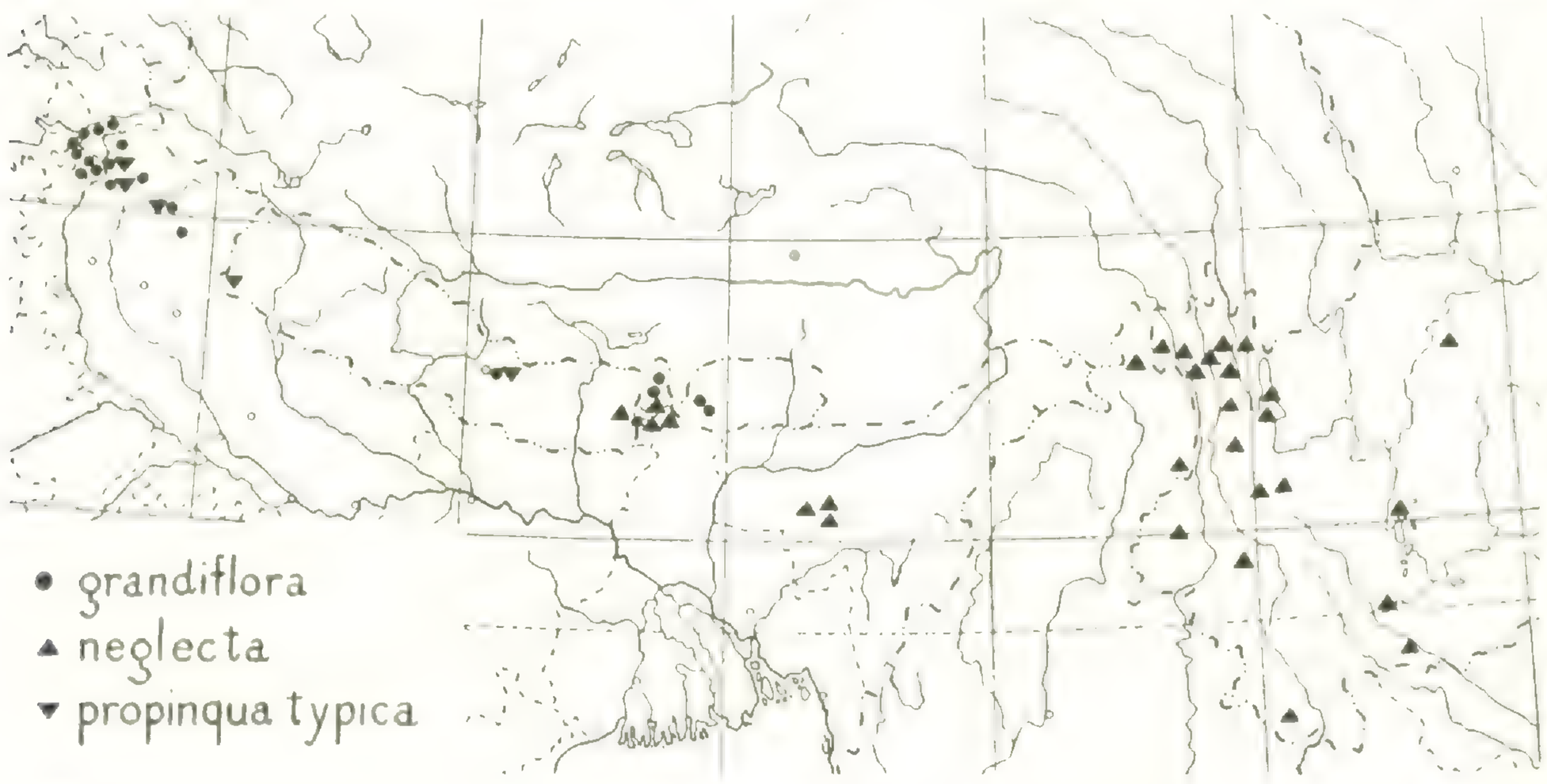

Fig. 16. Approximate known distribution of *Schisandra grandiflora, S. neglecta,* and *S. propinqua* var. *typica.*

or sometimes tending toward waxy-orange, the outermost segments in bud being sometimes reddish; anthesis occurs from April to June. The fruits at maturity (July to October) are red and edible. The following local names have been recorded: *Singoto* (Nepal); *Banoi, Ballon, Roal, Agali, Chimgaddi* (United Provinces).

Schisandra grandiflora and its two close allies, *S. rubriflora* and *S. incarnata,* are separable on rather slight characters, the flower-color being the most obvious of these. In many respects these three species appear to be the most primitive in the genus, and if ♂ flowers are available they cannot be confused with any other species. In herbaria and literature the binomial *S. grandiflora* has been accredited with a wide range extending into China and Indo-China, such records having been based on material of the two species mentioned above, *S. sphaerandra, S. perulata,* etc.

2. **Schisandra** (§ *Pleiostema*) **rubriflora** Rehder & Wilson in Sargent, Pl. Wils. **1**: 412. 1913.

Schizandra grandiflora sensu Franchet in Bull. Soc. Bot. Fr. **33**: 385. 1886, Pl. Delav. 34. 1889; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 48, p. p. 1905 [repr. Contr. Fl. As. Or. **2**: 48. 1907]; non Hook. f. & Thoms.

Schizandra chinensis var. *rubriflora* Franchet in Nouv. Arch. Mus. Hist. Nat. II. **8:** 192. 1886 [repr. Pl. David. **2:** 10. 1888].

Schisandra grandiflora var. *rubriflora* Schneid. in Bot. Gaz. **63:** 523. 1917; Rehder, Man. Cult. Trees and Shrubs 259. 1927, ed. 2. 254. 1940.

Schizandra rubriflora Rehder & Wilson ex Rehder in Bailey, Stand. Cycl. Hort. **6:** 3110. 1917; Pax & Hoffm. in Rep. Sp. Nov. Beih. **12:** 381. 1922; Anon. in Gard. Chron. III. **78:** 254. *f. 108* (p. 271). 1925; Leray in Rev. Hort. **97:** 450. *f. 167.* 1925; Stapf in Curtis's Bot. Mag. **152:** *tab. 9146.* 1928; Hand.-Maz. Symb. Sin. **7:** 244. 1931; Bean, Trees & Shrubs Brit. Isles **3:** 453. *pl.* 1933.

? Schizandra chinensis var. *rubra* Sprenger in Mitt. Deutsch. Dendr. Ges. **1907:** 16, nomen subnudum. 1908; Hort. ex Rehder in Bailey, Stand. Cycl. Hort. **6:** 3110. 1917; Leray in Rev. Hort. **97:** 449. 1925.

Schizandra sphenanthera sensu Kanj., Kanj., & Das, Fl. Assam **1:** 28. 1935; non Rehder & Wilson.

Schisandra sp. Merr. in Brittonia **4:** 52, p. p. 1941.

Glabrous throughout, apparently dioecious, resembling *S. grandiflora* in habit, with the branchlets often modified into short shoots; young branchlets purpurascent or brownish, angle-striate, 1–2.5 mm. in diameter, the older ones usually cinereous, subterete, 3–6 (–10) mm. in diameter; bud-scales papyraceous, broadly oblong, the largest ones about 8 × 8 mm., fugacious; leaves usually 4–6 per annual shoot; petioles 10–30 (–40) mm. long, 1–2 mm. in diameter; leaf-blades succulent when fresh, papyraceous when dried and brown to dark green above, paler beneath, obovate or elliptic to oblanceolate, (4–) 6–15 cm. long, (2–) 3–7 (–8.5) cm. broad, attenuate or rarely obtuse at base, cuspidate or acuminate at apex (acumen 3–10 mm. long, callose-apiculate), obviously denticulate (teeth 2–3 per centimeter, callose-apiculate or subspinulose) at margin or rarely inconspicuously so, the costa shallowly impressed or plane above, prominent beneath, the secondary nerves 5–8 per side, erecto-patent, slightly curved, somewhat irregular, plane or prominulous above, slightly or strongly elevated beneath, the veinlet-reticulation plane above, often conspicuously prominulous beneath; flowers arising as in *S. grandiflora;* ♂ flowers: pedicels slender, terete or faintly striate, 0.4–1.5 mm. in diameter, 20–50 mm. long at anthesis, ebracteolate or with 1 oblong bracteole up to 3 mm. long toward base; perianth-segments 5–8, all essentially similar, papyraceous to thin-carnose, elliptic to obovate, the largest ones 10–17 × 6–13 mm., the outermost and innermost 1 or 2 sometimes slightly reduced; androecium ellipsoid to subglobose, 6–12 × 8–14 mm. including stamens, composed of a subterete column (1.5–3 mm. in diameter) and 40–60 free stamens, these 4–7-seriate, the lowermost stamens usually 4–6 mm. long; filaments of lower stamens carnose, subterete or slightly flattened, (1.5–) 2–4 mm. long, the connective flattened, inconspicuous, sometimes obscurely glandular, subequal to thecae, the thecae extrorse or extrorse-lateral, 1.4–2 mm. long, the uppermost stamens sometimes smaller; ♀ flowers: pedicels like the ♂ but slightly stouter; perianth-segments similar to those of ♂ flowers; gynoecium oblong-ellipsoid, at anthesis 8–10 × 6–7 mm. including carpels, the column about 2 mm. in diameter; carpels 60–100, usually 7–9-seriate, the ovary obovoid, at anthesis 1.5–2.3 × 0.8–1.4 mm., the stigmatic crests conspicuous, soft-carnose, erosulous, 0.3–0.6 mm. broad, distally produced into a flattened pseudostyle 0.3–0.8 mm. long, proximally extended into a conspicuous irregular appendage; fruiting pedicel often slightly rugulose, 30–85 mm. long and usually 1–2.5 mm. in diameter at maturity, the torus stout, lightly angled, 2–6 mm. in diameter and 7–18 cm. long at full maturity, with usually 25–60 maturing carpels; carpels ellipsoid to subglobose, 8–11 × 6–9 mm.; seeds flattened-ellipsoid, 3.4–4 × 3–3.6 × 2–2.5 mm., the hilar margin nearly straight, the testa smooth, perhaps faintly undulate dorsally but not rugulose. FIG. 17, d.

TYPE LOCALITY: Niu-tou Shan, western Szechuan; *Wilson 921b,* cited below, is the type.

DISTRIBUTION: Southwestern China (Szechuan to northern Yünnan) to northern Burma and extreme northeastern Assam, at altitudes between 1200 and 3400 m. (most often 2000–3000 m.). See map, *fig. 18*. A variety of habitats has been recorded, including thickets, woods, forest, rocky slopes, ridges, ravines, etc., indicating that the species is not very selective in this respect.

CHINA: "Western China," *E. H. Wilson 3135* (K). SZECHUAN: Nan-ch'uan Hsien, *W. P. Fang 831* (A, K, NY), *893* (A), *1202* (A); Wa-sen country, Wen-chuan Hsien, *E. H. Wilson 921a* (A, K, US); west of Wen-chuan Hsien, *F. T. Wang 21001* (A); Kuan Hsien, *W. P. Fang 2374* (A, K, NY); Niu-tou Shan, w. of Kuan Hsien, *E. H. Wilson 921b* (A TYPE); Pan-lan Shan, w. of Kuan Hsien, *E. H. Wilson 4289* (A, K, US); Chiu-ting Shan, *E. H. Wilson 921* in part (A, GH, K, US); Hung-ya Hsien, *W. P. Fang 8270* (A, K, NY); O-mei Shan, *E. Faber 160* (K, NY), *W. P. Fang 2788* (A); Wa Shan, *E. H. Wilson 921* in part (A, GH, K, US); O-pien Hsien, *T. T. Yü 864* (A); Ma-pien Hsien, *W. P. Fang 1585* (A, NY); "Juei-she" [Yüeh-sui?] Hsien, *T. T. Yü 949* (A); without definite locality, *A. Henry 8798* (K). SIKANG: Vicinity of K'ang-ting (Ta-chien-lu), *A. E. Pratt 186* (K), *W. P. Fang 3650* (A), *E. H. Wilson 921* in part (A); near "Ta Kwan Ta Hsiang Ling," K'ang-ting trip, *C. Y. Chiao 1628* (A). YÜNNAN: "Kou-toui" [vicinity of Pai-yen-ching], *J. M. Delavay*, June 1887 (K); "Pé-long-tsin," *E. E. Maire 3358* (UC, US); Mt. Kenichunpo, Salwin–Irrawady divide, *J. F. Rock 22018* (A, NY, UC); A-tun (A-tun-tzu), Mt. "Kaakerpu" [Khawakarpo], *T. T. Yü 8511* (A); A-tun, *T. T. Yü 10319* (A), *10483* (A); Yeh-chih, Wei-hsi Hsien, *C. W. Wang 67966* (A); Wei-hsi Hsien, *H. T. Tsai 57914* (A), *57985* (A), *C. W. Wang 63735* (A); without definite locality, *T. T. Yü 8307* (A); "n. w. Yünnan" or "s. w. China," *Père Monbeig* in 1907 or without date (K); "western Yünnan," Herb. H. D. McLaren D. 77 (K).

BURMA: SAGAING: Myitkyina: Adung Valley, *F. K. Ward 9530* (A), *9593* (A).

INDIA: ASSAM: Delei Valley, *F. K. Ward 8210* (K), *8665* (K).

CULTIVATED: Hort. Kew, May 20, 1937 (K) (from Chenault, 1922); Bot. Gard. Glasnevin, Dublin, May 1924 (K); Comm. The Marquis of Headfort, 1929–31 (K) (Kells, Co. Meath, I. F. S.); Vereinsgarten Dendr. Ges. Oester.-Ungarn. (A) (seeds from *Wilson 921*); Hort. Vilmorin (A) (Verrières).

COLOR NOTES, etc.: The perianth-segments of this striking species are a shade of red variously recorded as dark red, cherry-red, crimson, scarlet, maroon, or purplish red; the androecium is of a similar color. Ward (no. *9530*) notes that the outer segments are yellow, but no other collector has mentioned this. Flowers at anthesis have been obtained in May and June, and fruits are mature from late July to October, in which condition they are red to intense crimson, scarlet, or brownish red. The only local name I find recorded is *Wu-wei-tzu*, noted by Wilson; more often this name is applied to *S. chinensis*.

SYNONYMY: Although the oldest epithet applicable to this species is *S. chinensis* var. *rubriflora* Franchet, it must be emphasized that Rehder and Wilson, in giving specific status to the concept, definitely proposed it as a new species based on a different type; it is not to be construed as a new combination based on Franchet's trinomial. Franchet's variety was based on a specimen collected by David at Mu-pin, Szechuan; it is obvious from his note on the flower-color and from the locality that David's plant represents *S. rubriflora*.

In transferring Franchet's trinomial to varietal status under *S. grandiflora*, Schneider inadvertently cited *Wilson 921b* as the type; this specimen, of course, is not the type upon which Schneider's combination is based.

The references to *S. grandiflora* cited above are based for the greater part on specimens from Szechuan and Yünnan which, it may be safely assumed, represent *S. rubriflora*. The reference to *S. sphenanthera* by Kanjilal et al., listed above, is based on material from the Delei Valley collected by Ward, doubtless the collections cited by me, above.

Schisandra rubriflora, by virtue of its large and vivid flowers, is perhaps the most striking member of the genus, as evidenced by such an excellent plate as that in Curtis's Bot. Mag. **152**: *tab. 9146*. Although, as indicated in my key to species, the only consistent and reliable character to differentiate this entity from *S. grandiflora* is the perianth-color, there are a few intangible foliage characters which may be mentioned. In general, the leaf-blades of *S. rubriflora* are slightly the broader in proportion, being prevailingly obovate rather than lanceolate; they are on the whole more obviously toothed; and the venation is more obvious and somewhat less regular.

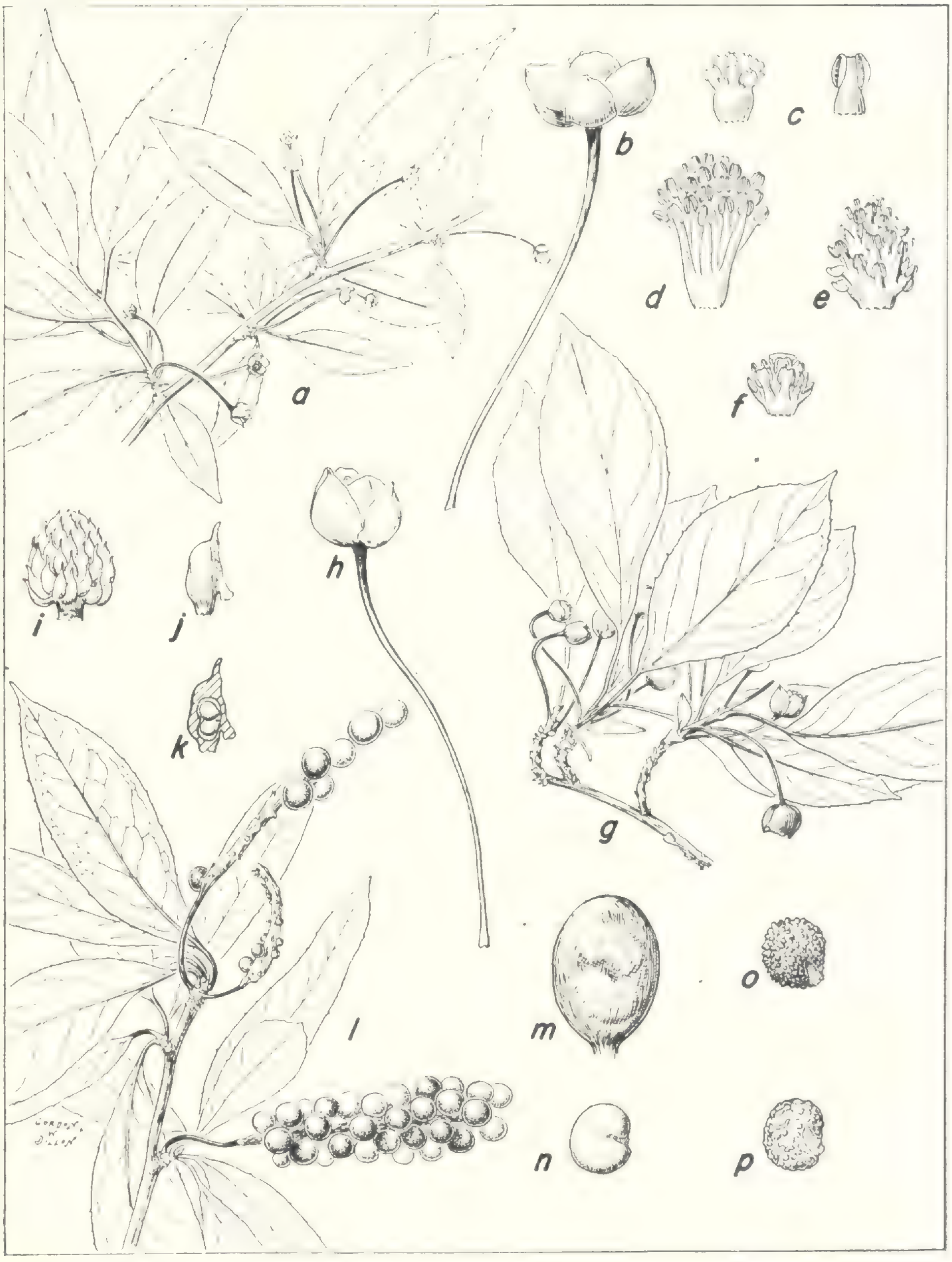

FIG. 17. *Schisandra* § *Pleiostema*. *a–c*. *S. lancifolia*: *a*. flowering branchlet, × ½; *b*. ♂ flower, × 2; *c*. androecium, × 2, and a detached stamen, introrse view, × 4. *d*. androecium of *S. rubriflora*, × 2. *e*. androecium of *S. sphaerandra* f. *typica*, × 2. *f*. androecium of *S. sphenanthera*, × 2. *g*. *S. neglecta*: flowering branchlet, × ½. *h–k*. *S. Wilsoniana*: *h*. ♀ flower, × 1; *i*. gynoecium, × 2; *j*. carpel, × 4; *k*. longitudinal section of carpel, × 4. *l–n*. *S. sphaerandra* f. *typica*: *l*. fruiting branchlet, × ½; *m*. mature carpel, × 2; *n*. seed, × 2. *o*. seed of *S. perulata*, × 2. *p*. seed of *S. Henryi* var. *yunnanensis*, × 2. *Figs. a–c* drawn from *Wilson 2552*; *d* from *Wilson 921*; *e* from *Forrest 4797*; *f* from *Wilson 1036*; *g* from *Rock 8933*; *h–k* from *Rock 4039*; *l–n* from *Schneider 3303*; *o* from *Pételot 4788*; *p* from *Tsai 61689*.

3. **Schisandra** (§ *Pleiostema*) **incarnata** Stapf in Curtis's Bot. Mag. **152**: sub *tab. 9146*, as *Schizandra i.* 1928.

Schizandra grandiflora sensu Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 48, p. p. 1905 [repr. Contr. Fl. As. Or. 2: 48. 1907]; non Hook. f. & Thoms.

Schisandra grandiflora sensu Rehder & Wilson in Sargent, Pl. Wils. 1: 411. 1913; non Hook. f. & Thoms.

Glabrous throughout, apparently dioecious, resembling *S. grandiflora* and *S. rubriflora* in habit; young branchlets purpurascent or brownish, slightly angled or striate, 1.5–3 (–4) mm. in diameter, the older ones usually cinereous, subterete, often rugulose, 2–5 mm. in diameter; bud-scales papyraceous, oblong, the largest ones 6–10 mm. long, fugacious; leaves 3–9 per annual shoot; petioles 15–35 mm. long, 1–1.5 mm. in diameter; leaf-blades papyraceous, when dried brownish or dark green above and slightly paler beneath, obovate or elliptic, (4–) 6–12 cm. long, (2–) 3–6 cm. broad, attenuate at base, cuspidate at apex (acumen 3–10 mm. long, callose-apiculate), usually obviously denticulate at margin with 2–3 teeth per centimeter, the costa slightly impressed or nearly plane above, prominent beneath, the secondary nerves 4–6 per side, subspreading or ascending, prominulous above, slightly elevated beneath, the veinlet-reticulation prominulous or plane above, usually more conspicuous beneath; flowers arising as in *S. grandiflora* and *S. rubriflora*; ♂ flowers: pedicels faintly rugulose, 0.5–1.3 mm. in diameter, 17–35 mm. long at anthesis, ebracteolate or with 1 oblong bracteole up to 3.5 mm. long near base; perianth-segments 7 or 8, all essentially similar, membranaceous to thin-carnose, elliptic to obovate, the largest ones 10–17 × 6–12 mm., the innermost 2 or 3 sometimes slightly the smallest; androecium ellipsoid to obovoid, composed of an inconspicuous column and about 29 free stamens, the lowermost stamens 6–8 mm. long; filaments of lower stamens submembranaceous, ligulate, 4–6 mm. long, the connective slightly thickened, obtuse, subequal to thecae, the thecae extrorse-lateral, 1.5–2 mm. long, the uppermost stamens with shorter filaments; ♀ flowers: pedicels like the ♂ but slightly stouter; perianth-segments similar to those of ♂ flowers; gynoecium oblong-ellipsoid, at anthesis about 8 × 7 mm. including carpels, the column 1.7–2 mm. in diameter; carpels about 70, usually 6- or 7-seriate, the ovary subfalcate-ellipsoid, at anthesis 1.8–2.2 × 0.8–1.2 mm., the stigmatic crests obvious, membranaceous, 0.1–0.2 mm. broad, distally produced into a subulate-flattened pseudostyle 0.2–0.3 mm. long, proximally extended into a small irregular appendage; fruiting pedicel 20–50 mm. long and about 1–2 mm. in diameter at maturity, the torus stout, irregularly angled, 1.5–4 mm. in diameter and 5–9 cm. long at maturity, with 20–50 maturing carpels; carpels ellipsoid, 10–11 × 6–8 mm. at maturity; seeds flattened-ellipsoid, about 4 × 3.2 × 2.5 mm., the hilar indentation slight, the testa smooth.

TYPE LOCALITY: Western Hupeh; four numbers collected by Wilson are cited without designation of a type, and below I cite these as cotypes.

DISTRIBUTION: Western Hupeh, at altitudes of 1500–2400 m., in thickets or woodlands. See map, *fig. 18*.

CHINA: HUPEH: Fang Hsien, *E. H. Wilson 318* (A, K COTYPE, US); Wen-tsao Mt., Hsing-shan Hsien, *E. H. Wilson 263* (A, K COTYPE, US); Hsing-shan Hsien and Fang Hsien, *E. H. Wilson 4574* (COTYPE COLL., A); "western Hupeh," *E. H. Wilson 2085* (A, K COTYPE, NY, US).

CULTIVATED: Arnold Arb. no. 7412 (A) (seed from *Wilson 318*); Bot. Gard. Edinb., May 25, 1937 (K) (seeds from *Wilson 318*); Hort. Kew, 1929 and 1937 (A, K) (seeds from *Wilson 318*); Hort. Veitch and Hort. Kew, 1907–09 (K) (Wilson seed no. 1026, from Ch'ang-yang Hsien, Hupeh); *A. Rehder* (A) (cult. Arnold Arb.).

COLOR NOTES: Wilson notes the perianth-segments (and apparently also the androecium) as flesh-pink in color; flowers are mature in May or June and fruits, as far as known, in September.

SYNONYMY: The references to *S. grandiflora* listed above are based, at least in part, on the Wilson specimens which were subsequently designated as cotypes of *S. incarnata*.

Schisandra incarnata is the easternmost representative of the group which I consider primitive in the genus. Its specific separation from *S. grandiflora* and *S. rubriflora* seems merited on the basis of its flower-color and its comparatively few stamens. Apparently it is an uncommon species, having been collected only by Wilson; Henry and others who have worked in western Hupeh seem to have overlooked it. Among the species of § *Pleiostema, S. sphenanthera* and *S. glaucescens* are also known from western Hupeh; the former might conceivably be confused with *S. incarnata* in sterile condition, but either ♂ or ♀ flowers permit the ready separation of the two species.

4. **Schisandra** (§ *Pleiostema*) **sphaerandra** Stapf in Curtis's Bot. Mag. **152**: sub *tab. 9146*, as *Schizandra s.* 1928.

Glabrous throughout, dioecious (or sometimes monoecious?), the branchlets often with cicatricose spur-like short shoots, the new portions purpurascent, striate-rugulose, 1–3 mm. in diameter, the older branchlets brownish or cinereous, subterete, 3–10 mm. in diameter, often with loose bark; bud-scales papyraceous, ovate-oblong or obovate, the largest ones 7–10 mm. long, scariose and often ciliolate at margin, fugacious; leaves 4–10 per annual shoot; petioles 9–20 (–30) mm. long, 0.6–1 mm. in diameter; leaf-blades when dried papyraceous or submembranaceous, dark green to brown above, paler or sometimes glaucous beneath, lanceolate or narrowly oblong-elliptic to oblanceolate, (3–) 4–11 (–13) cm. long, (1–) 1.5–4 cm. broad, attenuate at base, acute to cuspidate at apex (acumen not exceeding 6 mm. long, callose-apiculate), obscurely denticulate (teeth 1–3 per centimeter) or essentially entire at margin, the costa shallowly impressed or plane above, elevated or prominent beneath, the secondary nerves 3–6 per side, somewhat irregular, ascending or subascending, plane or faintly prominulous above, prominulous beneath, the veinlet-reticulation prominulous on both sides or plane above; ♂ flowers: pedicels slender, 0.6–1 (–1.8) mm. in diameter and 8–27 mm. long at anthesis, ebracteolate; perianth-segments about 2-seriate, 5–8, all essentially similar, when dried papyraceous to submembranaceous (or innermost thin-carnose), often scariose-margined, obscurely glandular, elliptic to obovate-elliptic, the largest ones 6–14 × 4.5–10 mm., the innermost 2–4 sometimes slightly reduced; androecium subglobose to ovoid, 5–10 × 5–7 mm. including stamens, composed of a cylindric-conical column and 20–50 stamens, these 4–6-seriate, crowded, the distal few sometimes more or less coadnate; filaments of lower stamens thin-carnose, ligulate, inconspicuous, 0.2–1.5 mm. long, the anthers oblong or deltoid-oblong, the upper anthers sessile, the connective faintly emarginate, the thecae parallel or oblique, extrorse-lateral, 0.7–1.5 mm. long; ♀ flowers: pedicels like the ♂ but slightly stouter; perianth-segments similar to those of ♂ flowers; gynoecium oblong-ellipsoid, at anthesis 6.5–10 × 4–7 mm. including carpels, the column about 1.5 mm. in diameter; carpels 6–9-seriate, 70–110, the ovary obovoid, at anthesis 1.3–2 × 0.8–1.3 mm., the stigmatic crests conspicuous, 0.2–0.5 mm. broad, membranaceous, distally produced into a flattened pseudostyle 0.2–0.5 mm. long, proximally extended into an appendage 0.5–0.8 mm. long; fruiting pedicel 0.8–2 mm. in diameter and 16–60 mm. long at maturity, the torus carnose, faintly angled, 1.5–5 mm. in diameter and 5.5–15 cm. long at full maturity, usually with 15–50 maturing carpels; carpels ellipsoid, 9–10 × 7–8 mm.; seeds flattened-ellipsoid, 4–4.3 × 3.5–3.8 × 2.2–2.5 mm., the hilar indentation slight, the testa distantly and very obscurely rugulose.

TYPE LOCALITY: Stapf cites four specimens, collected by Schneider, Handel-Mazzetti, and Forrest in southwestern Szechuan and northern Yünnan, in his original description without designating a type; these are cited below as cotypes, under f. *typica*.

DISTRIBUTION: Southwestern Szechuan and adjacent northern Yünnan, in a rather limited area.

Schisandra sphaerandra is a very distinct species, which seems in many respects to provide a transition from the *S. grandiflora* group to the rest of the section. In its extrorsely dehiscing anthers, its large perianth-segments, and its numerous carpels, *S. sphaerandra* suggests *S. grandiflora* and its immediate allies; but in its subsessile stamens *S. sphaerandra* differs from these presumably more primitive species. Within the concept there are two entities, one with red to magenta flowers and one with white to pink flowers. Except for the flower-color no differences are discernible, and the ranges of the two color-forms are not discrete. In this instance I believe that no more than formal status can be ascribed to the two entities. The differences in perianth-color among *S. grandiflora, S. rubriflora,* and *S. incarnata* are accompanied by other slight differences, and furthermore distinct geographical ranges are involved; for these reasons I have

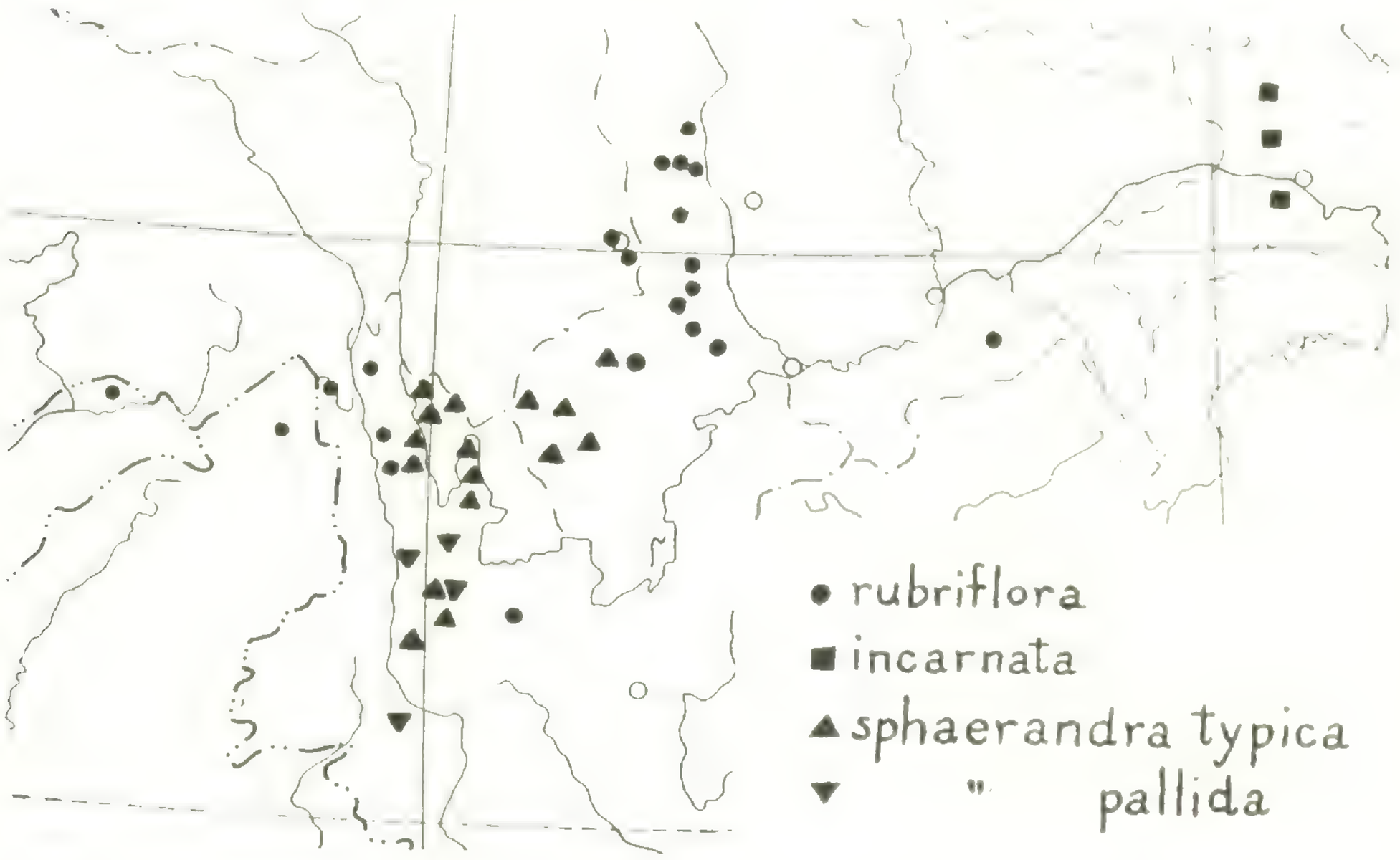

FIG. 18. Approximate known distribution of *Schisandra rubriflora, S. incarnata,* and *S. sphaerandra.*

preferred to maintain specific status for the three entities concerned. In the absence of flowers it will probably prove impossible accurately to refer specimens of *S. sphaerandra* to the appropriate form.

The species most likely to be confused with *S. sphaerandra* is *S. rubriflora,* which occurs in the same area. There can be no confusion, however, if staminate flowers are available, since these are quite different in androecial characters. In the absence of staminate flowers, there are several points which generally serve to identify the two species. On the average, the petioles of *S. sphaerandra* are the more slender and the shorter; the leaf-blades of *S. sphaerandra* are proportionately narrower, prevailingly lanceolate rather than obovate, with a shorter apex and less obvious marginal teeth, and with fewer secondaries and in general less obvious venation; the pedicels of ♀ flowers and even of fruits in *S. sphaerandra* average considerably the shorter; and the seeds of *S. rubriflora* are smooth, those of *S. sphaerandra* being somewhat rugulose, although often distantly and

very obscurely so. Furthermore, *S. sphaerandra* often occurs at higher elevations than *S. rubriflora* and possibly also in different ecological situations, a point which merits field investigation.

4a. **Schisandra sphaerandra** f. **typica** nom. nov.

Schisandra grandiflora var. *cathayensis* Schneid. in Bot. Gaz. **63**: 522. 1917; Rehder, Man. Cult. Trees and Shrubs 259. 1927, ed. 2. 254. 1940.

Schisandra glaucescens sensu Wilson in Jour. Arnold Arb. **7**: 237. 1926; non Diels.

Schisandra rubriflora sensu Wilson in Jour. Arnold Arb. **7**: 238. 1926; non Rehder & Wilson.

Schizandra sphaerandra Stapf in Curtis's Bot. Mag. **152**: sub *tab. 9146*. 1928; Hand.-Maz. Symb. Sin. **7**: 244. 1931.

The typical form, with crimson to magenta perianth-segments which are up to 13 × 9 mm. and faintly nerved from the base. FIG. 17, e, l–n.

TYPE LOCALITY: As noted above under the species.

DISTRIBUTION: As noted above under the species, at altitudes of 2700–3900 m. (possibly rarely as low as 2300 m.), in various habitats such as mixed forests, woods, thickets, open scrub, or fir or spruce forests. See map, *fig. 18*.

CHINA: SZECHUAN: Ta-hsiang-ling, *H. Smith 2031* (A); mountains of K'u-lu, Mu-li Kingdom, *J. F. Rock 18233* (A, US); "Kaushu shan on trail to Leirong," s. w. of Mu-li, *J. F. Rock 24092* (A, NY, UC); between Ka-la-pa and Liu-ku, *C. Schneider 1276* (A, K COTYPE); "Daörlbi," between Yen-yüan and Yung-ning, *H. v. Handel-Mazzetti 2962* (K COTYPE). YÜNNAN: North of Chung-tien, in Tonwa territory, *J. F. Rock 24699* (A, NY, UC, US), *25273* (A, UC); "Lamachang near Ngerya," border of Chung-tien [Hsien], *K. M. Feng 2883* (A); "Tamichung," n. w. Li-chiang Hsien, *R. C. Ching 20572* (A); Ha-ba, Chung-tien, *T. T. Yü 13497* (A); n. flank of Ha-ba Snow Range, *K. M. Feng 1217* (A); Mt. "Shwe-men-kai," s. e. of Chung-tien, *J. F. Rock 17292* (A, NY, US); s. e. Chung-tien, on way to A-nan-to, *K. M. Feng 934* (A); near Li-chiang, *C. Schneider 2807* (A), *3303* (A, GH, K); Li-chiang Snow Range, *T. T. Yü 15108* (A), *R. C. Ching 30216* (A); eastern flank of Li-chiang Range, *G. Forrest 2122* (K COTYPE), *5663* (K COTYPE, US), *J. F. Rock 3399* (A, NY, UC, US); "Tsze-kou" on Yangtze, *R. C. Ching 20644* (A); "Si-fang-za," n. w. Li-chiang, *R. C. Ching 22003* (A); Wei-hsi Hsien, *H. T. Tsai 59793* (A), *59950* (A); between "Sung-gueh" and Teng-ch'uan, *C. Schneider 2686* (A, GH, K); Ta-li Hsien, *C. W. Wang 63163* (A); Ta-li Range, *G. Forrest 4797* (A); Kan-hai-tzu, *J. M. Delavay*, May 21, 1889 (K); west of Ta-li, enroute to Yung-ch'ang and T'eng-yüeh, *J. F. Rock 6825* (A, US); "Muli, Wachin, Yunnanpuh," *T. T. Yü 14506* (A); "western Yünnan," Herb. H. D. McLaren C.57 (K); without definite locality, *T. T. Yü 5582* (A), *10075* (A), *11482* (A).

COLOR NOTES: The perianth-segments are red to crimson or magenta, and anthesis occurs in May or June; the flowers are often recorded as fragrant. The red fruits are mature from August to October.

SYNONYMY: *Schisandra grandiflora* var. *cathayensis* is typified by *Schneider 3936*, from Szechuan, a specimen not available to me. However, the other five specimens cited by Schneider (paratypes) are cited above and therefore his variety is well understood. These specimens are: *Forrest 4797, Schneider 2807, 3303, 2686,* and *1276*. Of these, *Schneider 1276* is also a cotype of *S. sphaerandra*.

The references to *S. glaucescens* and *S. rubriflora* listed above are based upon collections of Rock which are included in my citations.

4b. **Schisandra sphaerandra** f. **pallida** f. nov.

Schizandra grandiflora var. *cathayensis* sensu Wilson in Jour. Arnold Arb. **7**: 238. 1926; non Schneid.

Schizandra grandiflora sensu Hand.-Maz. Symb. Sin. **7**: 244, p. p. 1931; non Hook. f. & Thoms.

Planta a *f. typica* segmentis perianthii albis vel roseo-albis paullo majoribus (ad 14 × 10 mm.) e basi conspicuiore nervatis differt.

TYPE LOCALITY: Northwestern Yünnan; *Rock 8595,* cited below, is the best staminate specimen available and is designated as the type.

DISTRIBUTION: Northwestern Yünnan, occupying the southern part of the specific range, at altitudes of 2700–3250 m., sometimes noted as occurring in open situations. See map, *fig. 18.*

CHINA: YÜNNAN: Near Hao-ch'ing, *H. v. Handel-Mazzetti 8740* (K); between Chien-ch'uan plain and the Mekong drainage basin to La-chih-ming, *J. F. Rock 8595* (A TYPE, NY, UC, US), May 1923; eastern flank of Ta-li Range, *G. Forrest 7181* (K); Ta-li Hsien, *C. W. Wang 63258* (A); Shun-ning, Snow Range, *T. T. Yü 15976* (A); "Pé-long-tsin," *E. E. Maire 3359* (UC, US).

COLOR NOTES: The flowers, said to be fragrant, have white to pink or rose-colored perianth-segments and anthesis occurs in May or June. I have referred no fruiting specimens to this form, but it is possible that some of those cited under f. *typica* actually belong here.

SYNONYMY: The two references mentioned in the above synonymy are based on specimens which I cite as representing the new form.

The value of this form, which is purely a color-form and presumably not distinguishable from the typical form in fruiting condition, may well be questioned. I have proposed it merely to avoid the placing together of specimens which differ sharply in perianth-color, a character which as a rule is fairly dependable in *Schisandra.* As a specific entity *S. sphaerandra* is well marked, and there can be no question of referring the pale-flowered specimens to any other described species.

In his discussion of *S. rubriflora,* Stapf (in Curtis's Bot. Mag. **152**: *tab. 9146.* 1928) mentions that certain specimens from Yünnan with white or rose-colored flowers seem hardly separable from the Himalayan *S. grandiflora.* These are the specimens which I refer to *S. sphaerandra* f. *pallida,* which, if the androecium is available, cannot be confused with *S. grandiflora.*

5. **Schisandra** (§ *Pleiostema*) **perulata** Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1**: 55 (French descr. only, as *Schizandra p.*). *fig. 6 (3, 4).* 1938, in Not. Syst. Mus. Nat. Paris **8**: 65, as *Schizandra p.* 1939.

Schisandra grandiflora sensu Merr. in Jour. Arnold Arb. **19**: 28, p. p. 1938; non Hook. f. & Thoms.

Glabrous throughout, apparently dioecious; young branchlets brownish, 3–6 mm. in diameter, usually elongating, narrowly but obviously 3–5-winged (wings about 1 mm. broad, papyraceous or submembranaceous), the older branchlets cinereous, subterete, rugulose, copiously and conspicuously verrucose-lenticellate; bud-scales subtending annual shoots subpersistent, papyraceous, oblong-obovate, the largest ones 15–20 mm. long and 10–15 mm. broad, scariose and sometimes erosulous at margins; leaves 4–9 per annual shoot; petioles apparently very succulent when fresh, appearing winged (but probably merely canaliculate) when dried, 25–55 mm. long, 1.5–3 mm. in diameter; leaf-blades thin-papyraceous when dried (probably succulent when fresh), dark green to brownish and concolorous, ovate-elliptic, 9–18 cm. long, 5–11 cm. broad, acute or obtuse at base, acuminate at apex (acumen 10–20 mm. long, callose-apiculate), sinuate-denticulate (teeth about 1 per centimeter) or subentire at margin, the costa elevated on both sides, the secondary nerves 4–8 per side, curved-ascending or nearly straight, raised on both surfaces, the veinlet-reticulation extremely intricate, with free veinlets in the ultimate areoles, prominulous on both sides, obvious in the translucent blade; ♂ flowers: pedicels slender, 0.4–1.5 mm. in diameter, 35–75 mm. long at anthesis, apparently soft-carnose when fresh, becoming flattened and winged in drying, ebracteolate; perianth-segments about 7, the 3 or 4 outer ones papyraceous or thin-carnose, suborbicular to elliptic-obovate, 12–15 × 11–13 mm., obscurely nerved, sometimes glandular, the 3 or 4 inner ones thicker, obovate, enerved, 8–9 × 6.5–7.5 mm.; androecium subglobose, 7–9 mm. in diameter including stamens, composed of a soft-carnose column (2 mm. in diameter at base) and 24–30 free stamens, these 3- or 4-seriate, closely imbricate, oblong, the anthers sessile or subsessile (outermost stamens with carnose filaments 0.5–1 mm. long),

the connective thick-carnose, eglandular, 3–4 mm. long and 1.5–2 mm. broad, rounded at apex and slightly exceeding thecae, the thecae introrse-lateral, linear-oblong, 2.5–3 mm. long (of upper stamens 2 mm. long); ♀ flowers not seen, but probably with perianth similar to the ♂ and with at least 40 carpels; fruiting pedicel often flattening in drying, stout (1–2.5 mm. in diameter), 75–130 mm. long at maturity, the torus 3–4 mm. in diameter, 8–16 cm. long, with 20–40 maturing carpels; carpels 11–12 × 7–9 mm.; seeds flattened-subglobose, 4–4.5 × 4–4.5 × 3 mm., without a hilar indentation, the hilar scar conspicuous, transversely elliptic, slightly protruding, the testa copiously and very conspicuously verruculose-tuberculate (tubercles often 0.3 mm. long and broad). FIG. 17, o.

TYPE LOCALITY: Cha Pa, Tonkin, Indo-China; *Pételot 4788*, of which a duplicate is cited below, is the type collection.

DISTRIBUTION: Known only from the type locality, at an elevation of 1500 m., in "forêt claire." See map, *fig. 19*.

INDO-CHINA: TONKIN: Cha Pa, *A. Pételot 4788* (TYPE COLL., NY), Aug. 1933; same locality and collector, Apr. 1925 (A, US).

COLOR NOTES: According to the original description the species has colored bud-scales (presumably reddish or brown) and red flowers.

SYNONYMY: In 1938 Merrill cited two Pételot specimens as representing *S. grandiflora;* one of these subsequently became the type collection of *S. perulata,* while the second appears to be related to *S. pubescens,* under which I shall discuss it below.

Although it is one of the most sharply marked species in the genus, *S. perulata* is obviously allied to *S. Henryi,* with which it forms a well defined species-group. The extraordinarily translucent and intricately veined leaf-blades, the large flowers, and the strikingly tuberculate seeds amply distinguish the species from its ally.

In describing the aptly named *S. perulata,* Gagnepain cited only *Pételot 4788,* a fruiting specimen collected in August. As he also described the ♂ flowers, one may suspect his description to have been based in part on the other Pételot collection cited above, made in April, 1925, and unnumbered in American herbaria.

6. **Schisandra** (§ *Pleiostema*) **Henryi** Clarke in Gard. Chron. III. **38:** 162. *f. 55,* as *Schizandra H.* 1905.

Apparently dioecious, glabrous throughout (except leaves of var. *longipes*); young branchlets brownish or purpurascent, moderately elongate, 2–5 mm. in diameter, angled or 3–5-winged, sometimes conspicuously so, the older branchlets cinereous or blackish, subterete to angled or persistently winged, 2–7 mm. in diameter; bud-scales subtending annual shoots several, papyraceous, oblong or suborbicular, the largest ones 8–15 × 5–12 mm., persistent or subpersistent, usually not caducous at least until fruit is formed; leaves 3–9 per annual shoot; petioles 10–55 mm. long, 0.8–1.5 mm. in diameter; leaf-blades usually chartaceous, when dried brown to green above, paler beneath or glaucous or concolorous, ovate to ovate-elliptic, (5–) 7–14 cm. long, (2–) 3.5–10 cm. broad, attenuate to obtuse or subrounded at base, acuminate to cuspidate at apex (acumen 5–15 mm. long, callose-apiculate), obviously or obscurely denticulate at margin with 1 or 2 teeth per centimeter, the costa slightly impressed above and prominent beneath, the secondary nerves 4–6 per side, ascending, slightly curved or nearly straight, faintly prominulous above, elevated beneath, the veinlet-reticulation obviously anastomosing but not very intricate, prominulous on both sides; ♂ flowers: pedicels slender, 0.3–1 mm. in diameter proximally, enlarged upward to 0.7–2 mm., 16–70 mm. long at anthesis, ebracteolate; perianth-segments 6–10 (–13), the outer ones papyraceous or submembranaceous, the inner ones slightly thicker or thin-carnose, the outer 1 or 2 slightly or obviously the smallest, the largest ones suborbicular or broadly elliptic, 6–13 × 5–12 mm., often scariose-margined and obscurely glandular, the innermost 1–4 (–6) slightly or obviously reduced, obovate, 4–8

× 3–7 mm.; androecium ellipsoid or obovoid, 4–8 × 5–10 mm. including stamens, composed of a conical or clavate column (1.3–3 mm. in diameter), 14–40 free stamens (2–5-seriate), and a terminal irregular shield 2–5 mm. in diameter with about 6–9 marginal coadnate partially formed anthers; filaments of outermost stamens carnose, subterete or slightly flattened, 1–2 mm. long or less, the upper anthers sessile, the connective thick-carnose, obovoid or oblong, obscurely to copiously immersed-glandular, truncate to rounded at apex and exceeding the thecae, often conspicuously so, the thecae introrse-lateral, 1–2.3 mm. long (of upper stamens shorter); ♀ flowers: pedicels similar to ♂ but usually 50–120 mm. long at anthesis; perianth-segments essentially similar to those of ♂ flowers but probably not fewer than 8, sometimes up to 14 × 14 mm.; gynoecium subglobose or oblong-ellipsoid, 4–7 mm. in diameter at anthesis including carpels, the column 2.5–2.8 mm. in diameter; carpels usually 50–60, 4–7-seriate, the ovary 2–2.7 × 0.7–1 mm., the stigmatic crests obvious, membranaceous, distally produced into a subulate pseudostyle 0.3–0.8 mm. long, extended proximally into a conspicuous irregular appendage 0.5–1 mm. long; fruiting pedicels slender (0.5–2 mm. in diameter), 50–130 mm. long at maturity, the torus lightly angled, 1–4 mm. in diameter, 4–14.5 cm. long, with 15–45 maturing carpels; carpels 6–11 × 4–9 mm.; seeds flattened-subglobose or -ellipsoid, 3.2–4.3 × 2.8–3.8 × 2–3 mm., without a hilar indentation, the testa minutely to obviously rugulose or conspicuously so, the papillae often most obvious dorsally.

TYPE LOCALITY: In his brief diagnosis accompanying his original description of *S. Henryi*, Clarke cites: "*Henry* in *Herb. Kew*, 1785, et 9193b.! Hupeh and Szechuan, *Wilson!*" In the text, however, he states: "The species here illustrated (*fig. 55*) was introduced from Central China to the Veitchian nurseries by Mr. E. H. Wilson." While the original drawing was doubtless made from the living plant (a specimen from which is extant at Arnold Arb. in *Wilson 710*, cited below), it seems advisable, because of the specific epithet, to consider one of the Henry collections as the types. Of these two collections, no. *9193B*, from the Red River region of southern Yünnan, clearly represents the same entity as the cultivated plant illustrated and also the various Wilson plants from Hupeh and Szechuan doubtless referred to by Clarke. The other Henry number, *1785*, as clearly does not fall into the same concept, but on the other hand represents *S. pubescens*, of which, indeed, it was cited as a cotype by Hemsley and Wilson in the following year (1906). Neither of the two Henry numbers, at Kew, has been annotated as *S. Henryi* by Clarke, but it seems clear that his description refers to no. *9193B* and that the citation of no. *1785* was inadvertent. For these reasons I have no hesitation in considering the Kew sheet of *Henry 9193B* the actual type of *S. Henryi*.

DISTRIBUTION: Central and southern China, from Chekiang to Szechuan and southward to Kwangtung, Kwangsi, and Yünnan.

The species-group composed of *S. Henryi* and *S. perulata* is set off from the rest of § *Pleiostema* by its large and semi-persistent bud-scales, above which the young branchlets are either winged or sharply angled (only rarely inclined to be terete), and by its large stamens with flattened oblong connectives which usually obviously exceed the thecae. The stamens are easily recognized, although it may be difficult to define them in such a way that they can be readily told from those of *S. sphenanthera* and its allies, etc.

In its typical form, *S. Henryi* has the large bud-scales and winged branchlets in an extreme degree. This typical variety is central for the species, occurring in Hupeh, Hunan, Szechuan, Kweichow, Kwangsi, and southeastern Yünnan. Throughout the rest of southern Yünnan it is replaced by a form in which the bud-scale and branchlet characters are less pronounced, and in which there are slight modifications pertaining to the perianth and the androecium. This is undescribed and seems worth varietal status, as var. *yunnanensis*.

On the eastern and southern peripheries of its range, *S. Henryi* has other modifications here proposed as varieties. A Chekiang–Anhwei variant had the bud-

scale and branchlet characters less pronounced and the stamens reduced in number; this variety may also occur in Kwangsi and is to be anticipated in the intervening region of eastern China. It is here described as var. *marginalis*.

A local form in Kwangtung has the costa and secondary nerves of the leaves puberulent beneath; secondarily, this form appears to have the carpels more numerous than usual and the pseudostyle comparatively long and slender. This was described as *S. sphenanthera* var. *longipes* Merr. & Chun, and it is here transferred to *S. Henryi* as a variety.

Southward, in northern Indo-China, *S. Henryi* is replaced by a very distinct form with large flowers (especially obvious in the androecial characters), which has been described as *S. perulata*. This is worthy of specific rank.

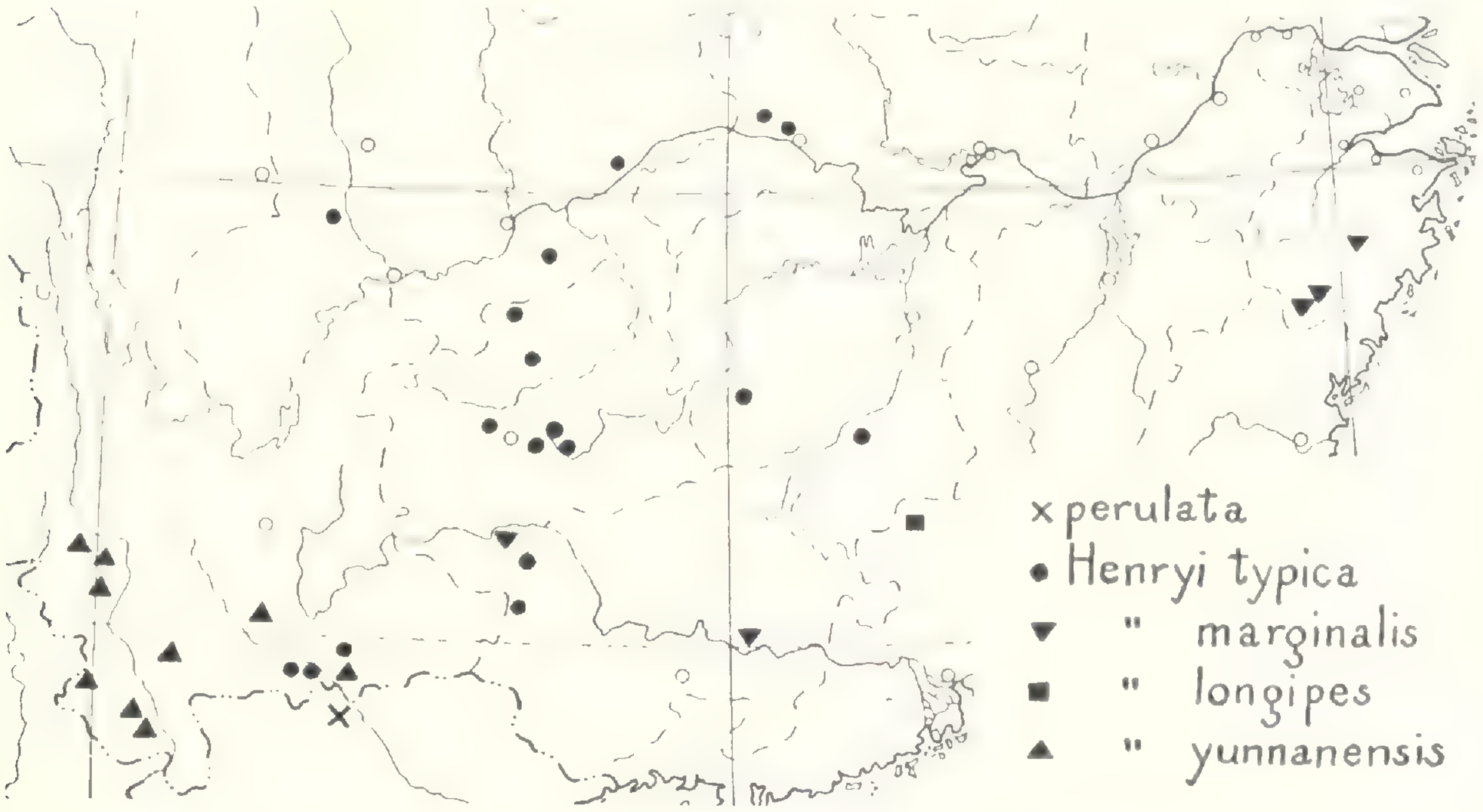

FIG. 19. Approximate known distribution of *Schisandra perulata* and *S. Henryi*.

In *S. Henryi* we thus have a fairly consistent typical variety in the center of the specific range, while toward the peripheries there occur slight variations, and in Indo-China a more pronounced variation which is maintained as a species.

KEY TO THE VARIETIES

Leaf-blades with the costa and secondary nerves beneath obviously pale-puberulent, broadly ovate, usually 8–12.5 × 5–10 cm.; young branchlets angled or very narrowly winged; petioles 20–45 mm. long; perianth-segments of ♀ flowers 8 or 9, the largest ones 12–14 × 10–14 mm.; carpels 55–60, with a conspicuous pseudostyle 0.5–0.8 mm. long; Kwangtung ..... c. var. *longipes*.

Leaf-blades glabrous throughout; carpels apparently not exceeding about 50, with a pseudostyle not exceeding 0.5 mm. in length.

Perianth-segments of ♂ flowers about 6; free stamens 14 or 15; seeds conspicuously rugulose; young branchlets angled or narrowly winged (wings not exceeding 1 mm. in breadth); petioles 10–30 mm. long; leaf-blades conspicuously glaucous beneath, narrowly ovate-elliptic, usually 7–11 × 3.5–5.5 cm.; Chekiang to Kwangsi.

b. var. *marginalis*.

Perianth-segments 7 or more; free stamens 22–40; petioles 15–55 mm. long; leaf-blades usually 7–14 × 4–8 cm.

Young branchlets with obvious wings 1–2.5 mm. broad; perianth-segments 7 or 8, the outermost one similar to the others or slightly reduced to 5–7.5 × 4–5 mm., the 1

or 2 innermost ones slightly reduced (7–8 × 5–7 mm.); outer stamens with filaments 1–2 mm. long; seeds rugulose, at least dorsally, but not tuberculate; leaf-blades often glaucous beneath; Hupeh, Hunan, and Kwangsi to Szechuan and southeastern Yünnan .....a. var. *typica*.

Young branchlets angled but scarcely winged, or the wings if present subcoriaceous and not more than 0.5 mm. broad; perianth-segments (at least ♂) 8–10 (rarely –13), the outermost 1 or 2 obviously smaller than the others, 2–6 × 2–5 mm., the 3 or 4 (–6) innermost ones also reduced (4–7 × 3–7 mm.); outer stamens subsessile, the filaments not exceeding 0.5 mm. in length; seeds conspicuously rugulose, nearly tuberculate; leaf-blades essentially concolorous; Yünnan .....d. var. *yunnanensis*.

6a. **Schisandra Henryi** var. **typica** nom. nov.

Schizandra Henryi Clarke in Gard. Chron. III. **38**: 162. *f. 55*. 1905 [repr. in Rep. Nov. Sp. **4**: 172. 1907]; Bean, Trees and Shrubs **2**: 504. 1914, in Kew Bull. **1914**: 52. 1914; Rehder in Bailey, Stand. Cycl. Hort. **6**: 3110. 1917; Leray in Rev. Hort. **97**: 449. 1925; Rehder in Jour. Arnold Arb. **10**: 191. 1929; Cheng in Ic. Pl. Omeiens. **1** (2): *pl. 70*. 1944.

Schizandra elongata var. *longissima* Dunn in Jour. Linn. Soc. Bot. **38**: 354, p. p. 1908.

Schizandra hypoglauca H. Lév. in Rep. Sp. Nov. **9**: 459. 1911, Fl. Kouy-Tchéou 270. 1914, Cat. Pl. Yun-Nan 175. 1916.

Schisandra Henryi Clarke ex Schneid. Ill. Handb. Laubholzk. **2**: 928. *f. 580*. 1912; Rehder & Wilson in Sargent, Pl. Wils. **1**: 413. 1913; Silva Tarouca, Freil.-Laubgeh. 343. *f. 444*. 1913; Rehder, Man. Cult. Trees and Shrubs 259. 1927, ed. 2, 254. 1940.

The typical variety, with obviously winged young branchlets (wings papyraceous or subcoriaceous, 1–2.5 mm. broad), the older branchlets angled or subterete or with persistent coriaceous wings, usually sparsely lenticellate; petioles 15–55 mm. long; leaf-blades when dried brown or dark green above, paler and usually glaucous beneath, (5–) 8–13.5 cm. long, (2–) 4–8 (–9.5) cm. broad, acute or attenuate at base, rarely rounded, usually obviously denticulate at margin; pedicels of ♂ flowers 28–70 mm. long at anthesis; perianth-segments 7 or 8, the outermost ones similar to the others or slightly reduced to 5–7.5 × 4–5 mm., the largest ones 9–12 × 6–11 mm., the innermost 1 or 2 slightly reduced to 7–8 × 5–7 mm.; androecium 5–8 × 7–10 mm., the free stamens 28–40, 3–5-seriate, the outer ones with filaments 1–2 mm. long; ♀ flowers with pedicels 60–120 mm. long, the gynoecium 4–5.5 mm. in diameter, the carpels about 50, the pseudostyle 0.3–0.5 mm. long; seeds with the testa obviously rugulose but not tuberculate.

TYPE LOCALITY: As noted above under the species.

DISTRIBUTION: South-central China (Hupeh and Szechuan southward to Honan, Kwangsi, and southeastern Yünnan), at altitudes of 450–2100 m., in a variety of habitats, such as thickets, forests, dense woods, rocky or brushy or open slopes, etc. See map, *fig. 19*.

CHINA: HUPEH: "Western Hupeh," *E. H. Wilson 2234a* (K); without definite locality, *A. Henry 6226* (A, GH), *E. H. Wilson*, July 1905 (K). HUNAN: Yün Shan, near Wukang, *H. v. Handel-Mazzetti 735* (12062) (A); Yang Shan, Ch'ang-ning Hsien, *C. S. Fan & Y. Y. Li 280* (A). SZECHUAN: Chung Hsien, *W. P. Fang 429* (A); Nan-ch'uan Hsien, *W. P. Fang 1116* (A), *1121* (A); O-mei Shan, *E. H. Wilson 4722* (A, K), *F. T. Wang 23221* (A), *C. Y. Chiao & C. S. Fan 230* (A), *773* (A). KWEICHOW: T'ung-tzu, *Y. Tsiang 5152* (NY); Lou Shan, T'ung-tzu Hsien, *W. Y. Chun 5152* (UC); Liang-feng-yah, Tsun-i Hsien, *A. N. Steward, C. Y. Chiao, & H. C. Cheo 132* (A, K, NY, US); between Kuei-ting and Tu-yün, *H. v. Handel-Mazzetti 195* (A); Tu-yün, *Y. Tsiang 5673* (NY); Tsao-feng-san, Ch'ing-chen Hsien, *S. W. Teng 90618* (A); "Yunnan-sen District," *J. Cavalerie 4118* (K); without definite locality, *J. Esquirol 58* (type coll. of *S. hypoglauca*, A, K). KWANGSI: Ling-yün Hsien, *S. K. Lau 28461* (A), *28629* (A); Tsin-hung Shan, N. Hin-yen, *R. C. Ching 6994* (A, NY, UC, US); "Tzu Yuen" Hsien, *T. S. Tsoong* [*Z. S. Chung*] *83594* (A). YÜNNAN: Meng-tzu, s. e. mountains, *A. Henry 9193* (A, K); "Feng Chen Lin," mountain, south of Red River, *A. Henry 9193B* (A, K TYPE; also cotype coll. of *S. elongata* var. *longissima* in part); south of Red River from Man-mei, *A. Henry 9193A* (cotype coll. of *S. elongata* var. *longissima* in part, A, K, US).

CULTIVATED: Hort. Veitch, June 1911 (A) (*E. H. Wilson 710*, with comment,

"from type plant," i. e. the plant upon which Clarke's original drawing was based); Bot. Gard. Edinb. (K).

LOCAL NAMES, COLOR NOTES, etc.: Wilson reports the name in Hupeh and Szechuan to be *Tieh-ku-san,* while Steward et al. record *Chuen-t'ou-tze* from Kweichow. These and several other collectors note that the fruits are edible. The perianth-segments are yellow or yellowish green and anthesis occurs between May and July; the fruits, which are mature in August and September, are red.

SYNONYMY: *Schizandra elongata* var. *longissima* is based upon four specimens, among which a type is not designated. Consequently I have considered all four to be cotypes. Two of the specimens, those collected by Henry in Yünnan, represent the typical variety of *S. Henryi* and are so cited above, while the other two represent *S. viridis,* to be discussed below. *Schizandra hypoglauca* is typified by *Esquirol 58,* cited above, a Kweichow collection which is entirely typical of *S. Henryi.*

6b. **Schisandra Henryi** var. **marginalis** var. nov.

Schisandra Henryi sensu Cheng in Contr. Biol. Lab. Sci. Soc. China **9**: 284. 1934; non Clarke.

Planta ubique glabra, ramulis hornotinis angulatis vel anguste alatis (alis ad 0.3–1 mm. latis), annotinis subteretibus vel angulatis copiose lenticellatis; petiolis 10–30 (–40) mm. longis; laminis in sicco plerumque supra viridibus subtus conspicue glaucis, anguste ovato-ellipticis, (6–) 7–11 cm. longis, (2.5–) 3.5–5.5 cm. latis, basi acutis vel attenuatis, margine obscure denticulatis; florum ♂ pedicellis gracillimis 0.5–1 mm. diametro sub anthesi 45–60 mm. longis; segmentis perianthii ut videtur 6, maximis 8–13 × 8–11 mm.; androecio 5–7 mm. diametro, staminibus liberis 2- vel 3-seriatis 14 vel 15, filamentis staminum exteriorum 1–2 mm. longis, connectivo thecae conspicue excedente, thecis 1–2 mm. longis; seminum testa ubique conspicue rugulosa.

TYPE LOCALITY: North of Hsien-chü, Chekiang; *Ching 1606,* the only good ♂ specimen available, is designated as the type.

DISTRIBUTION: Chekiang, southern Anhwei, and perhaps also Kwangsi, on the basis of the limited material available; to be anticipated from the intervening area. See map, *fig. 19.* Altitudes of 850–1330 m. are recorded, and such habitats as woods, dense woods, and roadside on mountains.

CHINA: CHEKIANG: 50 li north of Hsien-chü (Siachu), *R. C. Ching 1606* (A TYPE, UC, US), May 1924; Yün-ho Hsien, *S. Chen 660* (A); Ch'ing-yüan Hsien, *Y. L. Keng 354* (A), *R. C. Ching 2336* (A, US). KWANGSI: In-tung, Miu Shan, N. Lu-ch'eng, *? R. C. Ching 6236* (A, UC, US); Yao Shan, P'ing-nan Hsien, *? C. Wang 39328* (A).

COLOR NOTES, etc.: The only flowering specimens, those of the type collection, bore mature flowers in May and apparently had yellow perianth-segments. The fruits mature in August and September and are recorded as edible.

SYNONYMY: As representing *S. Henryi,* Cheng in 1934 cited some of the specimens I have listed above and also a specimen from southern Anhwei, which I have not seen but which probably also represents my new variety.

Although the entity described above certainly belongs in *S. Henryi,* I hesitate to leave it in the typical variety because of the reduced number of its stamens, its less obviously winged branchlets, and its discrete distribution at least as to the Chekiang and Anhwei elements.

6c. **Schisandra Henryi** var. **longipes** (Merr. & Chun) comb. nov.

Schisandra sphenanthera var. *longipes* Merr. & Chun in Sunyatsenia **2**: 5. 1934.

Young branchlets angled or very narrowly winged, the older ones terete, often striate; petioles 20–45 mm. long, faintly puberulent at least distally; leaf-blades when dried usually dark green and essentially concolorous, broadly ovate, (6–) 8–12.5 cm. long, (3.5–) 5–10 cm. broad, obtuse to rounded at base, obviously denticulate at margin, pale-puberulent on the costa and secondaries and sometimes on the tertiaries beneath; ♂ flowers not seen; ♀ flowers with pedicels 0.4–1.5 mm. in diameter and 55–90 mm. long at anthesis; perianth-segments 8 or 9,

the largest ones suborbicular, 12–14 × 10–14 mm.; gynoecium 6–7 mm. in diameter including carpels, the carpels 55–60, 5–7-seriate, the pseudostyle very conspicuous, subulate, 0.5–0.8 mm. long; fruit not seen.

TYPE LOCALITY: Lo-ch'ang, northern Kwangtung, collected by Tso.

DISTRIBUTION: Known only from the type locality and the two cotype collections cited below. See map, *fig. 19*. No altitudinal data are provided.

CHINA: KWANGTUNG: Lo-ch'ang, *C. L. Tso 20530* (NY COTYPE), *20679* (NY COTYPE).

COLOR NOTES: The flowers are greenish (young) or yellowish (mature); both known collections are ♀ and were obtained in May, 1929.

In their original publication, Merrill & Chun cite two collections from Szechuan as representing their variety, but these have no status as cotypes. In my estimation the Szechuan specimens are referable to *S. pubescens, Fang 1395* to var. typica and *Fang 2171* to var. *pubinervis*.

The close alliance of this entity to the typical variety of *S. Henryi* seems beyond question, but it is conceivable that discovery of ♂ flowers and fruits will make its elevation to specific status desirable.

6d. **Schisandra Henryi** var. **yunnanensis** var. nov.

Planta ubique glabra, ramulis hornotinis angulatis vel obscure alatis (alis subcoriaceis ad 0.5 mm. latis); petiolis 15–45 mm. longis; laminis in sicco supra fuscis vel fusco-viridibus subtus paullo pallidioribus haud glaucis, (6–) 7–14 cm. longis, (3–) 4–8 cm. latis, basi obtusis vel raro subrotundatis, margine plerumque obscure denticulatis; florum ♂ pedicellis 0.6–1.2 mm. diametro sub anthesi 16–65 mm. longis; segmentis perianthii 8–10 (–13), extimis 1 vel 2 minimis 2–6 × 2–5 mm., maximis suborbicularibus 6–11 × 5–12 mm., intimis 3 vel 4 (–6) 4–7 × 3–7 mm. saepe staminibus sterilibus similibus; androecio 4–6 mm. diametro, staminibus liberis 3- vel 4-seriatis 22–38, filamentis staminum exteriorum inconspicuis 0–0.5 mm. longis; seminum testa conspicue rugulosa fere tuberculata. FIG. 17, p.

TYPE LOCALITY: East of Ssu-mao, southern Yünnan; *Henry 12022*, the best ♂ specimen available, is designated as the type.

DISTRIBUTION: Southern Yünnan, at altitudes of 1100–2300 m., in mixed forests, woods, or thickets, often along streams or in ravines. See map, *fig. 19*.

CHINA: YÜNNAN: Chien-shui Hsien, *H. T. Tsai 53321* (A); P'ing-pien Hsien, *H. T. Tsai 55101, 55188, 55192, 60058, 60191, 60230, 60462, 60597, 60658, 61106, 61561, 61689, 62241* (all A); near Shun-ning, *T. T. Yü 16093* (A); Nan-chiao, *C. W. Wang 75326* (A); Wen-pi Shan, Mien-ning Hsien, *T. T. Yü 17763* (A); Po-shang, Mien-ning Hsien, *T. T. Yü 18069* (A); mountains east of Ssu-mao, *A. Henry 12022* (A TYPE, NY, US), May 30 [year?]; Ssu-mao, *A. Henry 12022A* (A, M, NY, US), *12022B* (A, K, NY); Lan-ts'ang Hsien, *C. W. Wang 76484* (A), *76601* (A), *76756* (A); Fo-hai, *C. W. Wang 73810* (A); Meng-sung, Dah-meng-lung, Ch'e-li Hsien, *C. W. Wang 77996* (A).

COLOR NOTES: The flowers, at anthesis in May and June, are predominantly yellow, but some collectors describe them as greenish yellow, pale orange, or yellowish without and reddish within. The red or scarlet fruits are mature from late July to October.

In most of southern Yünnan this variety seems to replace var. *typica;* in comparison it has less obvious branchlet-wings, more frequently caducous bud-scales, more definitely concolorous leaf-blades, more numerous and slightly modified perianth-segments, a more compact androecium and more conspicuously rugulose seeds.

7. **Schisandra** (§ *Pleiostema*) **pubescens** Hemsl. & Wilson in Kew Bull. **1906**: 150, as *Schizandra p.* 1906.

Apparently dioecious; branchlets subterete or faintly obtusely angled, often rugulose, the young ones brownish, 1–2.5 mm. in diameter, copiously brown-puberulent or glabrous, the older ones purpurascent to cinereous, up to 5 mm.

in diameter, glabrescent; bud-scales subtending annual shoots few, subcoriaceous, suborbicular, 1.5–5 mm. long, obscurely puberulent without or glabrous, fugacious; leaves 3–7 per annual shoot; petioles puberulent at least dorsally, 15–30 (–55) mm. long, 0.8–1.5 mm. in diameter; leaf-blades papyraceous to chartaceous, when dried brown above and paler beneath, elliptic or ovate-elliptic, (4.5–) 6–14 cm. long, 3.5–7 (–9) cm. broad, obtuse at base, cuspidate or acuminate at apex (acumen 4–10 mm. long, rarely 25 mm. long, callose-tipped), denticulate or sinuate-denticulate at margin with 1 or 2 teeth per centimeter, glabrous above, puberulent or pilose beneath with simple hairs at least on nerves, the costa impressed above, prominent beneath, the secondary nerves 4–6 per side, subspreading, slightly raised on both sides or subplane above, the veinlet-reticulation prominulous on both sides or plane beneath; flowers with few secondary subtending bracts, these often puberulent, less than 1.5 mm. long, fugacious; ♂ flowers (known only for var. *typica*): pedicels slender, 0.4–1.2 mm. in diameter, 20–30

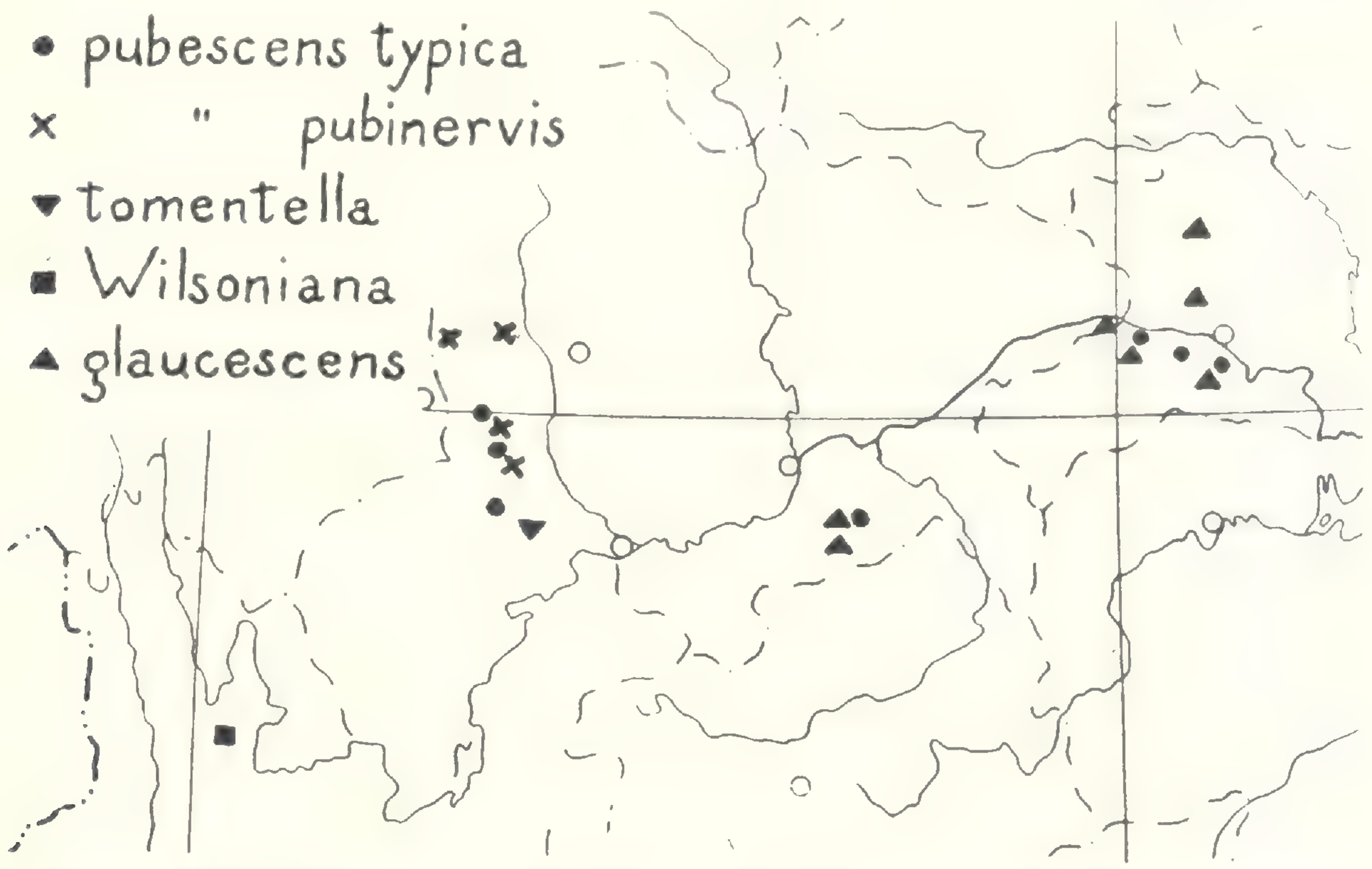

FIG. 20. Approximate known distribution of *Schisandra pubescens*, *S. tomentella*, *S. Wilsoniana*, and *S. glaucescens*.

mm. long at anthesis, ebracteolate, minutely puberulent; perianth-segments 7 or 8, the outer ones papyraceous, obscurely puberulent without, ciliolate, the inner ones thin-carnose, glabrous, the outer 1 or 2 elliptic, 4–6 × 3–6 mm., the largest ones suborbicular, 8–10 × 7.5–10 mm., the innermost 1 obovate, 7–8 × 6–7 mm.; androecium depressed-subglobose, 5–7 × 6–9 mm. including stamens, composed of a column (about 2 mm. in diameter), 19–24 free stamens, and a terminal shield about 2 mm. in diameter with 3–5 marginal anthers (or the stamens all free); outermost stamens 3–5 mm. long, the filaments subterete-flattened, 1–1.5 mm. long, the connective sparsely glandular, slightly exceeding thecae, the thecae introrse-lateral, 1.5–2.5 mm. long, the innermost stamens reduced in size; ♀ flowers: pedicels similar to ♂ or longer; perianth-segments 8–10, essentially similar to those of ♂ flowers or slightly larger (outermost ones scarcely reduced in var. *pubinervis*); gynoecium subglobose or oblong-ellipsoid, 5–7.5 mm. long and in diameter including carpels, the column about 2 mm. in diameter; carpels 45–55, 4–6-seriate, ovoid-ellipsoid, the ovary 1.8–2.5 × 0.7–1 mm., the stigmatic crests

membranaceous, erose-ciliolate, distally produced into a mucronate or subulate pseudostyle 0.2–0.4 mm. long, extended proximally into an irregularly oblong appendage; fruiting pedicels 0.6–2 mm. in diameter, 40–70 mm. long at maturity, puberulent or glabrous, the torus faintly angled, 1.5–4 mm. in diameter, 6–11 cm. long, with 25–55 maturing carpels; carpels usually 7–8 × 5–6 mm., the pericarp sometimes minutely puberulent; seeds flattened-ellipsoid, 3–3.7 × 2.5–3.3 × 2–2.5 mm., the testa smooth to very faintly rugulose dorsally.

TYPE LOCALITY: Western Hupeh; in the original publication three collections (*Wilson 2234* and *Henry 1785* and *5907*) are cited without designation of a type. As all of these clearly represent the same concept, I cite them as cotypes, below, under var. *typica*. It has been noted above under *S. Henryi* that *Henry 1785* was originally cited under that species, doubtless inadvertently.

DISTRIBUTION: Western Hupeh and Szechuan.

Two species with a certain obvious degree of pubescence on the lower leaf-surfaces, *S. pubescens* and *S. tomentella*, make up a species-group of the general alliance of *S. sphenanthera*, from which they may be distinguished not only by the pubescence and other less obvious foliage characters, but also by having their perianth-segments proportionately broader. I refer to *S. pubescens* a variety which Rehder & Wilson considered to belong to *S. sphenanthera*, since the latter species is typically glabrous throughout and has perianth-segments commonly obviously longer than broad.

The possible occurrence of *S. pubescens* as far south as Indo-China is indicated by *Pételot 4768* (NY), from "Col de Lo Qui Ho," alt. about 2000 m., near Cha Pa, Tonkin (cited by Merrill in Jour. Arnold Arb. **19**: 28. 1938 as *S. grandiflora*). I hesitate to refer this fruiting specimen to either of the varieties of *S. pubescens* here circumscribed. It is probably closer to var. *typica*, but the pubescence of the lower leaf-surface is somewhat more scattered than typical, the hairs being brown and densest on the nerves. Possibly this Pételot specimen is the basis, at least in part, of Gagnepain's description of "*Schizandra grandiflora*" in Humbert, Suppl. Fl. Gén. Indo-Chine **1**: 57. 1938.

KEY TO THE VARIETIES

Leaf-blades uniformly puberulent beneath (hairs 0.1–0.4 mm. long), the veins not much more densely so than the intervenous surfaces; pedicels (both ♂ and ♀) 20–30 mm. long at anthesis and minutely but densely puberulent; perianth-segments (both ♂ and ♀) 7 or 8, the outer one or two dorsally puberulent; carpels 50–55; Hupeh and Szechuan.
a. var. *typica*.

Leaf-blades crispate-pilose or short-tomentellous beneath on veins (hairs usually 0.3–0.7 mm. long), the intervenous surfaces essentially glabrous; pedicels of ♀ flowers 50–60 mm. long, glabrous; perianth-segment (♀) about 10, glabrous; carpels 45–50; Szechuan.
b. var. *pubinervis*.

7a. **Schisandra pubescens** var. **typica** nom. nov.

Schizandra pubescens Hemsl. & Wilson in Kew Bull. **1906**: 150. 1906; Rehder in Bailey, Stand. Cycl. Hort. **6**: 3110. 1917; Leray in Rev. Hort. **97**: 450. 1925; Hand.-Maz. Symb. Sin. **7**: 244. 1931; Bean, Trees and Shrubs Brit. Isles **3**: 454. 1933; Cheng in Ic. Pl. Omeiens. **1** (2): *pl. 72*. 1944.

Schisandra pubescens Hemsl. & Wilson ex Rehder & Wilson in Sargent, Pl. Wils. **1**: 413. 1913; Rehder, Man. Cult. Trees and Shrubs 259. 1927, ed. 2. 254. 1940.

Schizandra vestita Pax & K. Hoffm. in Rep. Sp. Nov. Beih. **12**: 381. 1922.

Plant with copiously puberulent young branchlets, the bud-scales obscurely puberulent without, the petioles puberulent like young branchlets; leaf-blades uniformly puberulent beneath with 3–10-celled hairs 0.1–0.4 mm. long; ♂ flowers as described above under the species; ♀ flowers with minutely but densely puberu-

lent pedicels 20–30 mm. long; perianth-segments about 8; carpels 50–55; fruiting pedicels copiously but minutely puberulent, the maturing carpels 30–55.

TYPE COLLECTION: As noted above under the species.

DISTRIBUTION: Western Hupeh and Szechuan, at altitudes of 1200–2550 m., the habitat most often being mentioned as thickets. See map, *fig. 20.*

CHINA: HUPEH: Ch'ang-yang, *E. H. Wilson 2234* (A, K COTYPE, NY); Chien-shih, *A. Henry 5907* (GH, K COTYPE, US); Pa-tung Hsien, *A. Henry 1785* (K COTYPE), *E. H. Wilson 158* (A, K, US). SZECHUAN: Nan-ch'uan Hsien, *W. P. Fang 1395* (A, K, NY); "Tal des Yo ho bei Ming kan schan," Ya-chou, *W. Limpricht 1572* (A photo. and fragm. of type [Breslau] of *S. vestita*); O-mei Shan, *W. P. Fang 2632* (A, K, NY); O-pien Hsien, *T. T. Yü 844* (A); "Ngo-pi" Hsien, *W. P. Fang 7362* (A).

COLOR NOTES, etc.: The flowers, at anthesis in May or June, have yellow or yellowish green perianth-segments; the red fruits are mature in August and September. Wilson records the local name of *Wu-wei-tzu* in Hupeh, but this is probably generic in the region.

SYNONYMY: The identity of *S. vestita* with *S. pubescens* has already been noted by Handel-Mazzetti and Cheng, in the publications listed above. The correctness of this is attested by the photograph and fragment of the type of *S. vestita* cited above.

7b. **Schisandra pubescens** var. **pubinervis** (Rehder & Wilson) comb. nov.

Schisandra sphenanthera var. *pubinervis* Rehder & Wilson in Sargent, Pl. Wils. 1: 415. 1913.

Schizandra sphenanthera var. *pubinervis* Rehder & Wilson ex Cheng in Ic. Pl. Omeiens. 1 (2): *pl. 71.* 1944.

Plant in general less copiously pilose than var. *typica,* the young branchlets and bud-scales essentially glabrous, the petioles often puberulent only dorsally; leaf-blades copiously or sparsely crispate-pilose or short-tomentellous beneath on nerves with 5–12-celled hairs 0.3–0.7 mm. long, the ultimate veinlets and intervenous surfaces essentially glabrous; ♂ flowers not known; ♀ flowers with glabrous pedicels 50–60 mm. long; perianth-segments about 10, glabrous, all essentially similar but the innermost 2–3 reduced; carpels 45–50; fruiting pedicels glabrous, the maturing carpels 25–30.

TYPE LOCALITY: Near "Monkong Ting" [Mou-kung], western Szechuan; *Wilson 2551,* cited below, is the type.

DISTRIBUTION: Western Szechuan, at altitudes of 1000–2100 m., in thickets. See map, *fig. 20.*

CHINA: SZECHUAN: Kuan Hsien, *W. P. Fang 2171* (A, K, NY); near Mou-kung, *E. H. Wilson 2551* (A TYPE, K, US); Hung-ya Hsien, *E. H. Wilson 897* in part (K, US), *W. P. Fang 8330* (K); O-mei Shan, *W. P. Fang 7658* (US), *7765* (A, K), *F. T. Wang 23281* (A).

COLOR NOTES: From the very sparse data at hand it appears that the perianth-segments are yellow and that anthesis occurs in June; mature fruits have been collected in August and September.

In my opinion the entity discussed above is better referred to *S. pubescens* than to *S. sphenanthera,* although in the degree of foliage-pubescence it is somewhat intermediate. In their original discussion of this variety, Rehder & Wilson list as a paratype *Henry 6447* (GH, K), from Hsing-shan, western Hupeh. This fruiting specimen has the pedicels 8–11 cm. long and the fruiting torus up to 18 cm. long—dimensions exceeding those of the specimens cited above. Furthermore, the Henry specimen has only the faintest pubescence on the nerves of the lower leaf-surfaces. I do not believe that the Henry collection is referable to this variety, and possibly it does not even represent the species; for the time being I cannot place it.

8. **Schisandra** (§ *Pleiostema*) **tomentella** sp. nov.

Planta monoica vel ut videtur dioica; ramulis subteretibus vel striatis, hornotinis brunneis copiose tomentellis 1.5–3 mm. diametro, annotinis cinerascentibus

ad 5 mm. diametro demum glabrescentibus; squamis subcoriaceis suborbicularibus 2–3 mm. longis plus minusve glabris fugacibus; foliis 4–6 per ramulum hornotinum, petiolis ut ramulis tomentellis 10–30 mm. longis 0.8–1 mm. diametro; laminis submembranaceis vel papyraceis in sicco supra fusco-viridibus subtus pallidioribus, ellipticis vel obovato-ellipticis, (5–) 7–11 cm. longis, (3.5–) 4–6.5 cm. latis, basi acutis vel attenuatis, in apicem 3–15 mm. longum calloso-apiculatum acuminatis vel cuspidatis, margine denticulatis (dentibus 2 vel 3 per centimetrum), supra glabris, subtus copiose tomentellis (pilis brunneis multicellularibus ramulosis 0.5–1 mm. longis), costa supra leviter impressa subtus elevata, nervis secundariis utrinsecus 4 vel 5 subadscendentibus supra prominulis subtus paullo elevatis, rete venularum utrinque subprominulo; floribus ♂: pedicellis gracilibus 0.3–1.2 mm. diametro sub anthesi 20–43 mm. longis sparse crispato-pilosis (pilis gracilibus pluricellularibus 0.1–0.3 mm. longis) ebracteolatis; segmentis perianthii 2-seriatis 5 vel 6, exterioribus 3 papyraceis vel submembranaceis minute ciliolatis suborbicularibus vel ellipticis 4.5–8 × 4–6.5 mm. extus minute puberulis vel subglabris, intimis 2 vel 3 paullo incrassatis glabris 4–6 × 3.5–5 mm.; androecio subgloboso vel obovoideo staminibus inclusis 3–5 mm. diametro, columna 1.5–2 mm. diametro, staminibus liberis 18–20, pelta apicali irregulari 1.5–2 mm. diametro antheris semisterilibus 3–5 marginata; staminibus liberis 2- vel 3-seriatis, exterioribus 1.5–2.5 mm. longis, filamentis carnosis 0.2–0.5 mm. longis, connectivo oblongo thecas saepe excedente, thecis introrso-lateralibus 0.7–1.5 mm. longis; floribus ♀: pedicellis ♂ similibus ad 2 mm. diametro; segmentis perianthii circiter 7 ♂ similibus sed exterioribus 9–10 × 8–9 mm. interioribus 7–8 × 6–10 mm.; gynoecio subgloboso sub anthesi 5–6 mm. diametro, columna circiter 2 mm. diametro, carpellis 6- vel 7-seriatis circiter 70, ovario falcato-obovoideo 1.5–2 × 0.8–1.2 mm., cristis stigmatiferis inconspicuis superne haud productis inferne in appendiculam oblongam extentis; fructu non viso.

TYPE LOCALITY: Ma-pien Hsien, western Szechuan; *Fang 408,* a specimen with both ♂ and ♀ flowers, is indicated as the type.

DISTRIBUTION: Known only from the type locality, at altitudes of 1300–2200 m., in thickets. See map, *fig. 20.*

CHINA: SZECHUAN: Ma-pien Hsien, *W. P. Fang 408* (A TYPE, NY, US), May 23, 1930, *F. T. Wang 22845* (A), *23052* (A).

COLOR NOTES: The available specimens, all flowering, were obtained in May, and Wang records the flowers as yellow.

This apparently rare species is one of the most readily recognized in *Schisandra.* The tomentum of its lower leaf-surfaces is composed of a mass of tangled, branched, many-celled brown hairs, which under high magnification are seen to be strikingly different from the simple hairs of the foliage of *S. pubescens.*

9. **Schisandra** (§ *Pleiostema*) **elongata** (Bl.) Baill. Hist. Pl. **1**: 148. *f. 182* (?), as *Schizandra e.* 1868–69.

Sphaerostema elongatum Bl. Bijdr. Fl. Ned. Ind. 23, as *S. elongata.* 1825; Spreng. Syst. Veg. **4** (2): 261. 1827; Bl. Fl. Jav. [Schizandr.] 17. *tab. 5.* 1830.

Sphaerostemma elongatum Bl. ex G. Don, Gen. Syst. **1**: 101, as *S. elongata.* 1831; Walp. Rep. Bot. Syst. **1**: 92. 1842; Miq. Fl. Ned. Ind. **1** (2): 19, p. p. 1858.

Schizandra elongata Hook. f. & Thoms. ex Backer, Schoolfl. voor Java 16. 1911; Koorders, Exkursionsfl. Java **2**: 243. *f. 51.* 1912.

Glabrous throughout, apparently dioecious; branchlets subterete-striate, the young ones brownish, 1.5–4 mm. in diameter, elongated, the older ones often purpurascent or cinereous, up to 5 mm. in diameter; bud-scales fugacious; leaves 5–10 per annual shoot; petioles slender (0.7–1.2 mm. in diameter), 17–35 mm. long; leaf-blades papyraceous, when dried brownish or dark olivaceous above and paler to subglaucous beneath, ovate, 8–13 (–15) cm. long, 5–8.5 cm. broad, rounded or broadly obtuse or subcordate at base and abruptly decurrent on the

petiole, acuminate or caudate-acuminate at apex (acumen 1–2 cm. long, slender, callose-tipped), undulate or subentire or obscurely and remotely callose-denticulate at margin, the costa impressed above, prominent beneath, the secondary nerves 3–5 per side, arcuate-ascending, prominulous above and obviously elevated beneath, the veinlet-reticulation prominulous on both sides; flowers axillary to foliage leaves, with fugacious subtending bracts; ♂ flowers: pedicels slender, 0.5–1 mm. in diameter, 20–40 mm. long before anthesis, ebracteolate [bracteolate near middle, ex Bl.]; perianth-segments about 3-seriate, 9 or 10, the 2 outermost ones papyraceous, suborbicular, obscurely glandular, minutely ciliolate, 2–4.5 mm. long and broad, the largest ones (3 or 4) somewhat thicker, eciliate, before anthesis 5–7 × 5–8.5 mm. [up to 13 × 13 mm. ex Bl., *tab. 5*], the inner ones subcarnose, obovate-suborbicular, as small as 2–3 mm. long; androecium subglobose, 4–4.5 mm. in diameter at anthesis including stamens, composed of a conical column, 18–25 free stamens, and an apical shield 1.5–2.5 mm. in diameter with 4–10 partially fertile anthers at margins; free stamens 2- or 3-seriate, the anthers sessile, the connective obovoid-oblong, immersed-glandular, subequal to thecae in length, the thecae lateral, 0.8–1.2 mm. long on outermost anthers; ♀ flowers: pedicels at anthesis 55–65 mm. long; perianth-segments apparently as in ♂ flowers; gynoecial column about 2 mm. in diameter, the carpels apparently about 20–25, the ovary falcate-ellipsoid, after anthesis about 2.5–3 × 0.9–1.3 mm., the stigmatic crests produced into a subulate pseudostyle 0.3–0.8 mm. long, proximally extended into 1 or 2 irregular linear appendages about 0.5 mm. long; fruiting pedicels slender (0.5–1.5 mm. in diameter), 60–80 mm. long at maturity, the torus 1.5–3.5 mm. in diameter and 5–7 cm. long, usually with 10–20 maturing carpels; carpels obovoid, 8–9 × 5–6 mm., the seeds ellipsoid-subspherical, slightly flattened, 3.2–3.5 mm. long, 3–3.3 mm. broad, the hilar indentation none, the hilar scar conspicuous, the testa obviously rugulose.

TYPE LOCALITY: In his original publication, Blume cites "in altis montis Burangrang Provinciae Krawang," and this therefore to be taken as the type locality. In his second and detailed discussion, Blume adds the citation of a second locality: "prope *Tugu* ad promontorium montis ignivomi *Gedé*." Both localities are in West-Java. The Kew specimen cited below bears no data and one cannot be sure which of the above localities it represents; I mention it as a type collection, although this may not be strictly the case.

DISTRIBUTION: Java, at altitudes of 1200–2200 m. See map, *fig. 21*. Habitat records are inadequate, but the species doubtless occurs in montane forest.

JAVA: *Mousset 964* (US). MIDDEN-JAVA: Goenoeng Lawoe, *J. H. Coert*, Oct. 26, 1932 (A), Goenoeng Soembing, *C. A. Backer 12291* (K). WEST-JAVA: *C. L. Blume* (TYPE COLL., K); Bandoeng, *J. J. Smith & Rant 408* (K); Tjibodas, Mt. Gede, *H. Hallier 750* (NY), *S. H. Koorders 31516β* (K); Tjigenteng, Mt. Gede, *S. H. Koorders 26392β* (K).

DATES OF FLOWERING, etc.: No data as to flower-color are available to me, but flowering specimens taken in April and October are available, as are fruiting specimens taken in January and March. Blume mentions having observed ♀ flowers and fruits in July, ♂ flowers in April.

SYNONYMY: As originally circumscribed by Blume, *Sphaerostema elongatum* is a clearly marked Javanese species, but many later writers, doubtless influenced by Hooker & Thomson (Fl. Ind. **1**: 85. 1855), have extended the concept to include Himalayan and Chinese plants, which are mostly referable to *S. neglecta*, described below. The combination in *Schisandra* is frequently accredited to Hooker & Thomson, but their publication of it (in Hook. f. Fl. Brit. Ind. **1**: 44. 1872) is antedated by Baillon's. Baillon's publication of the binomial is inconspicuous but adequate, although one cannot tell to what extent his concept of the species also included Himalayan plants.

Schisandra elongata, as might be expected from its geographical position, is not closely allied to any continental species, being sharply marked by its ovate and usually round-based leaf-blades, its comparatively few stamens and carpels, and its sharply reduced outermost and innermost perianth-segments. From the other known Javanese species of the genus, *S. axillaris*, of § *Sphaerostema*, it is

of course strikingly different in androecial characters. A discussion of my choice of a lectotype of the genus *Sphaerostema* Bl. has been given above, under the treatment of that name as a section of *Schisandra*.

10. **Schisandra** (§ *Pleiostema*) **Wilsoniana** sp. nov.

Schisandra elongata sensu Wilson in Jour. Arnold Arb. 7: 238, p. p. 1926; non Baill.

Planta ubique glabra ut videtur dioica, ramulis hornotinis fusco-purpurascentibus saepe brevibus striato-rugulosis obtuse angulatis 1–3 mm. longis, annotinis cinerascentibus rugulosis ad 7 mm. diametro; squamis pluribus papyraceis late orbicularibus ad 10 mm. diametro fugacibus; foliis 3–5 per ramulum hornotinum, petiolis 10–20 mm. longis gracilibus (0.5–1 mm. diametro); laminis in sicco submembranaceis vel papyraceis supra fusco-olivaceis subtus valde pallidioribus albescentibus, ovato-ellipticis, (5–) 7–12 cm. longis, (2.5–) 3.5–6 cm. latis, basi acutis, in apicem 5–10 mm. longum calloso-apiculatum acuminatis, margine inconspicue

FIG. 21. Approximate known distribution of *Schisandra elongata* and *S. axillaris*.

calloso-denticulatis, costa supra impressa subtus elevata, nervis secundariis utrinsecus 4 vel 5 subadscendentibus utrinque prominulis, rete venularum subplano vel minute prominulo; floribus ♂ non visis; floribus ♀ axillaribus vel e ramulis hornotinis infra folia ortis; pedicellis gracilibus 0.4–1.3 mm. diametro sub anthesi 40–60 mm. longis ebracteolatis; segmentis perianthii 6 vel 7 subsimilibus tenuiter carnosis saepe obscure pellucido-glandulosis, extimo elliptico 8–9 × 6–7 mm., maximis suborbicularibus 11–12 × 10–11 mm. margine scariosis, intimis obovatis interdum ad 7 × 6 mm. reductis; gynoecio subgloboso sub anthesi 5–6 mm. diametro, columno cylindrico circiter 2 mm. diametro, carpellis 5- vel 6-seriatis 60–75, ovario oblongo-ellipsoideo subfalcato 2–2.5 × 0.7–0.9 mm., cristis stigmatiferis membranaceis erosuloso-ciliolatis superne in pseudostylum conspicuum subulatum 0.5–0.8 mm. longum productis inferne in appendiculam oblongam extentis; fructu non viso. FIG. 17, h–k.

TYPE LOCALITY: West of Hao-ch'ing, northern Yünnan; *Rock 4039* is the type.

DISTRIBUTION: Known only from the type collection. See map, *fig. 20*.

CHINA: YÜNNAN: Mountains west of Hao-ch'ing, south of Li-chiang, *J. F. Rock 4039* (A TYPE, UC, US), May 25–28, 1922.

COLOR NOTES: The type, with yellow flowers, was obtained in May, as noted above.

SYNONYMY: Two collections of Rock were listed by Wilson under *S. elongata*; one of these is designated as the type of the new species and the other is referable to *S. neglecta*.

Although it is known from only a single ♀ collection, *S. Wilsoniana* seems so

well marked that it must be established as a new species. Although obviously a member of the group which includes *S. glaucescens, S. neglecta,* and their allies, the new species is recognized by a combination of characters, including comparatively large and subentire leaf-blades which are conspicuously glaucous beneath, large suborbicular perianth-segments, and numerous carpels with an unusually obvious pseudostyle.

11. **Schisandra** (§ *Pleiostema*) **glaucescens** Diels in Bot. Jahrb. **29:** 323, as *Schizandra g.* 1900; Rehder & Wilson in Sargent, Pl. Wils. **1:** 413. 1913; Rehder, Man. Cult. Trees and Shrubs 259. 1927, ed. 2. 254. 1940.

Schizandra elongata sensu Diels in Bot. Jahrb. **29:** 322. 1900; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 49, p. p. 1905 [repr. Contr. Fl. As. Or. **2:** 49. 1907]; non Baill. nec sensu Hook. f. & Thoms.

Schizandra glaucescens Diels ex Rehder in Bailey, Stand. Cycl. Hort. **6:** 3110. 1917; Leray in Rev. Hort. **97:** 449. 1925; Bean, Trees and Shrubs Brit. Isles **3:** 454. 1933.

Glabrous throughout, apparently dioecious; branchlets subterete, often rugulose, the young ones usually purpurascent, 1–3 mm. in diameter, when fertile usually reduced to short shoots, the older ones cinerascent, 2.5–6 mm. in diameter; bud-scales few, papyraceous, elliptic or obovate, rarely as large as 15 × 8 mm., fugacious; leaves 3–7 per annual shoot; petioles 10–20 (–30) mm. long, 0.6–1.5 mm. in diameter; leaf-blades chartaceous, when dried brownish above and paler to obviously glaucescent beneath, oblong- to obovate-elliptic, (5–) 6–10 cm. long, (1.5–) 3–5.5 cm. broad, acute to attenuate at base, cuspidate or acuminate at apex (acumen 3–10 mm. long, callose-apiculate), denticulate or serrulate at margin with 1 or 2 teeth per centimeter, the costa impressed above, prominent beneath, the secondary nerves 3–5 per side, ascending or subspreading, prominulous above, more obviously raised beneath, the veinlet-reticulation prominulous or nearly plane on both sides; ♂ flowers: pedicels slender, 0.4–1.2 mm. in diameter, 18–35 mm. long at anthesis, ebracteolate; perianth-segments 6 or 7, the outer ones papyraceous, scariose-margined, obscurely glandular, elliptic-oblong, sometimes obscurely ciliolate, 8–13 × 5–8 mm., the inner ones thin-carnose, elliptic to obovate, similar in size or the innermost slightly reduced; androecium subglobose, 3–6 mm. in diameter at anthesis including stamens, the column 2–3 mm. in diameter, surmounted by an irregular apical shield 1–2.5 mm. in diameter with partially fertile anthers at its edges, the free stamens 2- or 3-seriate, 18–25, the lower ones with minute carnose flattened filaments 0.1–0.5 mm. long, the connective obovoid or ellipsoid, often yellow-glandular, truncate, subequal to thecae or slightly exceeding them, the thecae introrse-lateral or essentially lateral, 1–1.5 mm. long; ♀ flowers: pedicels as in ♂ flowers but 30–50 mm. long at anthesis; perianth-segments essentially as in ♂ flowers; gynoecium subglobose, at anthesis 4.5–7 mm. in diameter including carpels, the column cylindric, 2–2.3 mm. in diameter, the carpels 4- or 5-seriate, about 50, the ovary falcate-ellipsoid, 2–2.3 × 0.8–1.2 mm., obtuse or subacute at apex but without a pseudostyle, the stigmatic crests narrow, erose-ciliolate, adnate to ovary distally, proximally free and extended into a conspicuous irregularly oblong appendage; fruiting pedicels slender, not exceeding 1.5 mm. in diameter, 45–70 mm. long at maturity, the torus rugulose, irregularly angled, 3–5 mm. in diameter, 5–10 cm. long, with 20–45 maturing carpels; carpels at maturity 9–12 × 7–9 mm., narrowed at base into a stipe 1–2 mm. long, the pericarp obscurely yellow-glandular; seeds flattened-ellipsoid, 3.5–4.2 × 3–3.7 × 2–2.5 mm., the hilar indentation inconspicuous, the testa smooth.

TYPE LOCALITY: "Kin shan" [Chin Shan], eastern Szechuan; *Bock & von Rosthorn 131,* of which a photograph is cited below, is the type.

DISTRIBUTION: Western Hupeh and adjacent eastern Szechuan, at altitudes of 1200–2700 m., in thickets. See map, *fig. 20.*

CHINA: HUPEH: Fang Hsien, *E. H. Wilson 164* in part (A), *164a* (A, K, US); Hsing-shan Hsien, *E. H. Wilson 164* in part (A, GH, K, US); Ch'ang-yang, *E. H. Wilson 883* in part (A, K, US); Pa-tung Hsien, *A. Henry 1827* (K, US), *E. H. Wilson 883* in part (A, NY); western Hupeh, *E. H. Wilson 179a* in part (K), *W. Y. Chun 3820* (A); without definite locality, *A. Henry 5478* (GH), *5931* (GH, K, US), *6292* (NY), *6383* (GH, US). SZECHUAN: S. Wu-shan, *A. Henry 5725* (GH, K); Nan-ch'uan Hsien, *W. P. Fang 855* (A, K); Chin Shan, s. w. of Nan-ch'uan, *C. Bock & A. von Rosthorn 131* (A photo. of TYPE [Oslo, Universitetets Botaniske Museum]).

CULTIVATED: Hort. Kew (A) (from seed of *Wilson 164a*).

COLOR NOTES, etc.: Anthesis occurs from April to June, and according to Wilson the perianth-segments are orange-red. The scarlet fruits are mature between July and October. According to Bock & von Rosthorn a local name is *Wu-wei-t'êng* and the fruit is edible.

SYNONYMY: The references to *S. elongata* listed above mention specimens included in my citations.

Among the species of its immediate alliance, the only one which occurs in the same region as *S. glaucescens* and which therefore might be confused with it is *S. sphenanthera.* These two entities are indeed very close, but *S. glaucescens* can usually be readily distinguished by having its narrower leaf-blades more conspicuously glaucous beneath, by its more numerous stamens, and by its lack of a pseudostyle. The latter character is probably not very reliable, in view of the great variability of the stigmatic crests throughout *Schisandra,* but in all the ♀ specimens of *S. glaucescens* available to me the stigmatic crests are distally decurrent on the ovary and do not extend beyond it.

12. **Schisandra** (§ *Pleiostema*) **sphenanthera** Rehder & Wilson in Sargent, Pl. Wils. **1**: 414. 1913; Rehder in Jour. Arnold Arb. **5**: 147. 1924, Man. Cult. Trees and Shrubs *260.* 1927, ed. *2.* 254. 1940; Silva Tarouca & Schneid. Freil.-Laubgeh. ed. 3. *340. f. 405.* 1931; Dandy in Curtis's Bot. Mag. **147**: *tab. 8921.* 1938.

? Schizandra japonica sensu Hance in Jour. Bot. **18**: 258. 1880; non Sieb. & Zucc. ex A. Gray (*S. chinensis*).

? Schizandra chinensis sensu Maxim. in Acta Hort. Petrop. **11**: 39. 1889; Diels in Bot. Jahrb. **29**: 322. 1900; Pavolini in Nuovo Giorn. Bot. Ital. **15**: 403. 1908; ? H. Lév. Fl. Kouy-Tchéou 270. 1914; non Baill.

Schizandra sphenanthera Rehder & Wilson ex Rehder in Bailey, Stand. Cycl. Hort. **6**: 3110. 1917; Leray in Rev. Hort. **97**: 450, as *S. sphaenanthera.* 1925; Hand.-Maz. Symb. Sin. **7**: 245. 1931; Bean, Trees and Shrubs Brit. Isles **3**: 453. 1933.

Apparently dioecious, glabrous throughout or very rarely with the leaf-blades faintly puberulent on nerves beneath; branchlets subterete, often somewhat rugulose, elongate or modified into cicatricose short shoots, the young ones usually purpurascent, 1–3 mm. in diameter, the older ones cinerascent, 3–5 (–8) mm. in diameter; bud-scales papyraceous, suborbicular to obovate-oblong, up to 12 mm. long but usually smaller, fugacious; leaves usually 3–9 per annual shoot; petioles 10–25 (–30) mm. long, about 1 mm. in diameter; leaf-blades papyraceous, drying somewhat membranaceous, brownish or dark green above, slightly paler beneath or concolorous, obovate to broadly elliptic or lanceolate-elliptic, (3–) 5–11 cm. long, (1.5–) 3–7 cm. broad (rarely up to 15 × 8 cm. on vigorous young shoots), acute to attenuate at base, cuspidate or gradually acuminate at apex (acumen 3–10 mm. long, callose-tipped), sinuate- or serrulate-denticulate at margin with about 2 teeth per centimeter, the costa plane above or slightly impressed proximally, elevated beneath, the secondary nerves 4 or 5 per side, erecto-patent, usually curved, prominulous above, more obviously raised beneath, the veinlet-reticulation sometimes intricate, usually inconspicuous, faintly prominulous or plane on both sides; ♂ flowers: pedicels slender, 0.3–1.2 mm. in diameter, 20–45 mm. long at anthesis, ebracteolate; perianth-segments 2- or 3-seriate, 5–8, all essentially similar, thin-carnose, scariose-margined, eglandular or with dorsal yellow glands, elliptic to oblong-obovate, the outer 3 or 4 usually

7–12 × 4–8 mm., the inner ones often obovate, 5.5–9 × 3.5–6 mm.; androecium obovoid, 4–6 mm. in diameter including stamens at anthesis, the column cylindric or obovoid, 1–2 mm. in diameter, free of stamens proximally, surmounted by an irregular apical shield 1.5–2.5 mm. in diameter composed of 4 or 5 partially fertile anthers (or these sometimes all free), the free stamens 2- or 3-seriate, 11–19, the lower ones 1.6–2.5 mm. long, with filaments up to 1 mm. long, the connective obovoid, 1.5–2 mm. long, 0.7–1.4 mm. broad at apex, copiously yellow-glandular or not, subequal to thecae or slightly exceeding them, the thecae introrse-lateral, 1–1.5 mm. long, often oblique and subcontiguous at base; ♀ flowers: pedicels as in ♂ flowers but 25–60 mm. long at anthesis; perianth-segments essentially as in ♂ flowers or the largest ones somewhat broader, 8–11 × 5–9 mm.; gynoecium subglobose, 5–5.5 mm. in diameter at anthesis including carpels, the column about 1.7 mm. in diameter, the carpels about 4-seriate, 30–50, the ovary subfalcate-ellipsoid, 1.5–2.5 × 0.7–1 mm., the stigmatic crests narrow, erose-ciliolate, produced into a minute pseudostyle 0.1–0.2 mm. long, proximally extended into conspicuous irregular appendages; fruiting pedicels 0.5–1.8 mm. in diameter, 35–100 mm. long at maturity, the torus lightly angled and irregular, 1–4 mm. in diameter, 6–17 cm. long, usually with 20–40 maturing carpels; carpels at maturity 8–12 × 6–8 mm., the seeds ellipsoid, 3.7–4.4 × 3–3.8 × 2.5–3 mm., the hilar indentation essentially none, the testa smooth or faintly undulate or rarely dorsally slightly rugulose. FIG. 17, f.

TYPE LOCALITY: Pa-tung Hsien, Hupeh; *Wilson 313,* cited below, is the type.

DISTRIBUTION: The species has an extensive range in central China, from southern Kiangsu westward to southern Shansi, Shensi, and Kansu, and southward to Anhwei, Hunan, Kweichow, and northeastern Yünnan. See map, *fig. 22.* Altitudes of 600 to 2400 m. have been recorded, and such habitats as thickets, woods, grassy ridges, ravines, stream-banks, etc.

CHINA: KIANGSU: Hai-wei, s. of I-hsing, *R. C. Ching & C. L. Tso 498* (A). ANHWEI: Huang-shan, *R. C. Ching 3008* (A, K); T'ien-chu Shan, Chien-shan Hsien, *C. S. Fan & Y. Y. Li 220* (A); "Chu Hwa" Shan, s. Anhwei, *R. C. Ching 2591* (*7516*) (A; K, UC). SHANSI: Shih-li-p'o Shan, Yüan-ch'ü Hsien, *H. Smith 6577* (A). HONAN: Yü-tai Shan, Teng-feng Hsien, *J. Hers 243* (A); "Tsi Li Ping," Yung-ning, *J. Hers 424* (A), *452* (A, K), *1335* (A); Shih-tzu-miao, Sun Hsien, *J. Hers 1246* (A); "Hiung Eul" Shan, Lu-shih Hsien, *J. Hers 860* (A), *887* (A); Lao-chün Shan, Lu-shih Hsien, *J. Hers 1220* (A). SHENSI: Hua-shan, *J. Hers 3089* (A); T'ai-pai Shan, *W. Purdom 1037* (A, K, US); "Monte di Kian-san," *J. Giraldi,* Aug. 4, 1909 (A, K). KANSU: "Kuan-kia-ho," s. e. Kansu, *E. Licent* (K). HUPEH: Hsing-shan Hsien, *E. H. Wilson 245* (A, K, US), *2553* (A, K), *2554* (A, K, US), *Y. Chen 15205* (UC); vicinity of I-ch'ang, *A. Henry 3446* (GH, K), *3469* (GH, K, US); Nan-t'o and mountains to northward, *A. Henry 4609* (K); Nan-t'o, *E. H. Wilson 779* (A, K, NY); Ch'ang-yang, *E. H. Wilson 675* (A, K, NY); Pa-tung Hsien, *A. Henry 4040* (K), *4059* (GH, K), *E. H. Wilson 313* (A TYPE, K, US), *H. C. Chow 210* (A, NY), *689* (A, NY); western Hupeh, *E. H. Wilson 179* (K), *179a* in part (A, NY), *1036* (A, K), *1968* (A, K, NY). SZECHUAN: Mao-chou, Wa Shan, and Mu-pin (specimens mixed), *E. H. Wilson 866* (A, GH, K, US); Wa-sen country, Wen-ch'uan Hsien, *E. H. Wilson 869a* (A, K, US); west of Wen-ch'uan Hsien, *F. T. Wang 21043* (A); Kuan Hsien, *W. P. Fang 2172* (A, K, NY), *2238* (A, K); west of Kuan Hsien, *F. T. Wang 20827* (A); south of Kuan Hsien, *F. T. Wang 20682* (A); Mu-pin, *E. H. Wilson 869* (A, K, US); T'ien-ch'üan Hsien, *K. L. Chu 2583* (K); Hung-ya Hsien, *E. H. Wilson 897* in part (A); Ma-pien Hsien, *F. T. Wang 23026* (A); between Hai-t'ang and Pin-yi-p'u, *H. Smith 1964* (A); without definite locality, *A. Henry 5527* (NY), *5527A* (A, GH, US), *8796* (K). SIKANG: Vicinity of K'ang-ting (Ta-chien-lu), *A. E. Pratt* (K). HUNAN: Shih-men, *A. Henry 7934* (K); near Hsin-hua, *H. v. Handel-Mazzetti 784* (*11933*) (A); Yün Shan, near Wu-kang, *T. H. Wang* (in Handel-Mazzetti) *95* (A); vicinity of "Mingdjingtjüan," *H. v. Handel-Mazzetti 595* (*11740*) (A). KWEICHOW: P'ing-fa, *J. Cavalerie 27* (K). YÜNNAN: Chao-t'ung Hsien, *H. T. Tsai 50888* (A).

CULTIVATED: *A. Rehder* (Arnold Arb. 7411) (A) (seed from *Wilson 313*); *A. Rehder* (Arnold Arb. 17234) (A) (seed from *Wilson 897*); *C. R. Howard* (S. P. I. 40025) (A) (seed from Pao-chi, Shensi, coll. F. N. Meyer Sept. 15, 1914); Hort. Kew, May 25,

1937 (K); Cult. Nuneham Park, Oxford, no. H. 956–15 (K); Hort. Bot. Gard. Glasnevin, Dublin (K); Hort. Vilmorin (A) (Verrières).

LOCAL NAMES, COLOR NOTES, etc.: The following local names are recorded by Hers: *Liao-wei, Wu-wei-tze, Mu-kua-jang, Ling-tao* (in Honan), *Pa-yüeh-cha* (in Shensi); the same collector records the fruits as edible. Possibly some of these names and the note as to use pertain to *S. chinensis,* a species readily confused with *S. sphenanthera* but occurring to the northward. Anthesis occurs from April to July, and collectors have noted such various flower-colors as yellow, greenish yellow, orange, orange-yellow, orange-red, and "green, bronze within." The excellent plate accompanying Dandy's discussion (in 1938, cited above) shows the outer perianth-segments greenish to yellow and the inner ones orange to nearly red. The fruits are said to be red or scarlet and to mature between July and September.

SYNONYMY: It seems probable that the references to *S. japonica* and *S. chinensis* listed

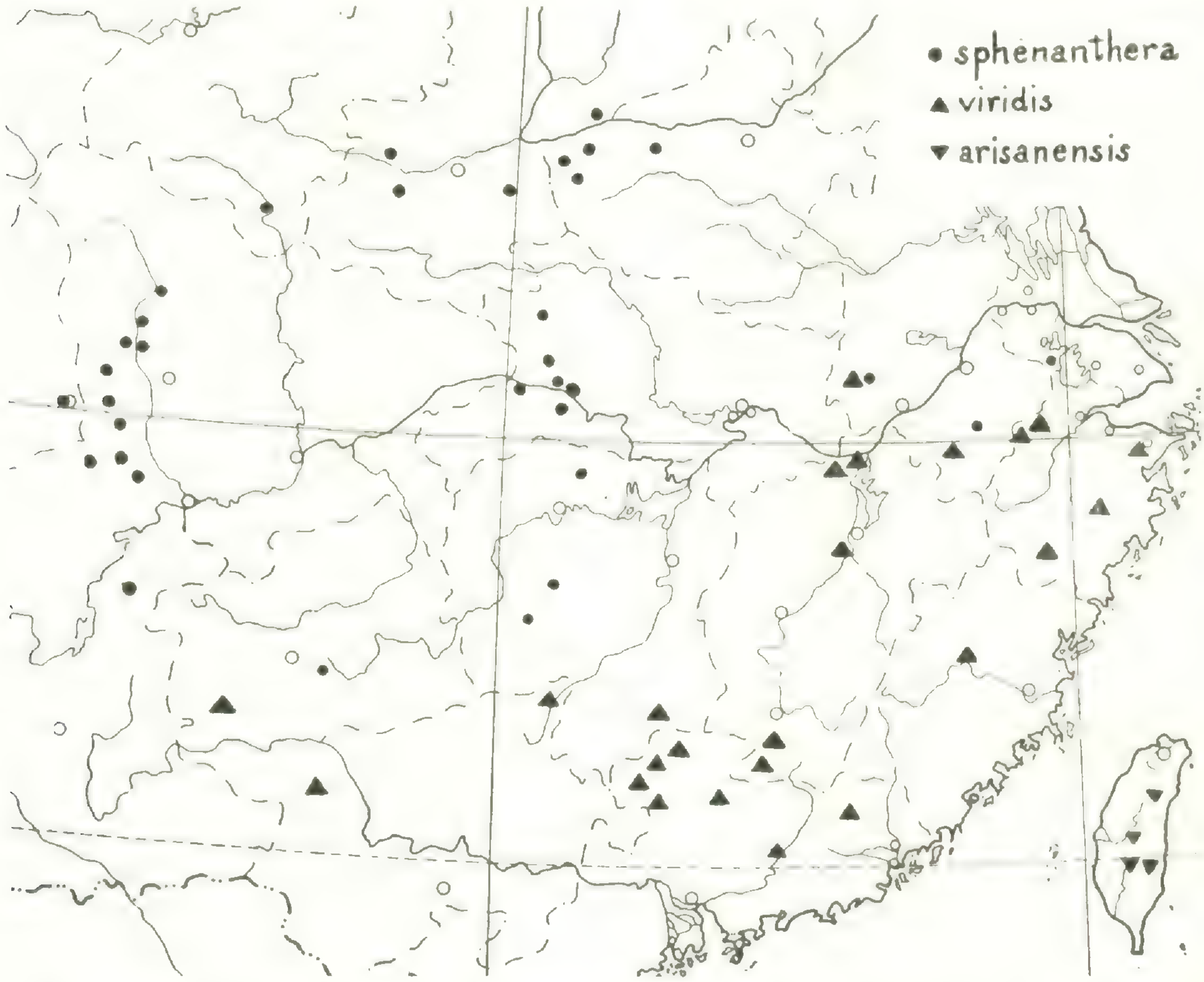

FIG. 22. Approximate known distribution of *Schisandra sphenanthera, S. viridis,* and *S. arisanensis.*

above are based primarily upon specimens of *S. sphenanthera;* at least the localities mentioned fall within the range of this species and to the south of the range of *S. chinensis* as I interpret it.

It will be found very difficult to distinguish certain sterile or fruiting specimens from the northern periphery of the range of *S. sphenanthera* from the southern extensions of *S. chinensis,* although the two species fall into different sections and differ strikingly in androecial characters. I have not observed any actual overlap of the ranges of the two species, but *S. chinensis* is known to occur fairly far southward in Shansi. As a rule, the costa and secondaries of the lower leaf-surfaces of *S. chinensis* have a few (often minute, but characteristic) short brown crisped scattered hairs, which are never found in *S. sphenanthera.* As has been

implied by Rehder & Wilson and others, most if not all of the references to the occurrence of *S. chinensis* south of central Shansi pertain to *S. sphenanthera*.

Although *S. sphenanthera* must be one of the most common plants in parts of its range, in my opinion it has been too broadly interpreted in herbaria and in literature. In their original publication Rehder & Wilson appended descriptions of two varieties, both of which I remove from the species, var. *pubinervis* to varietal rank under *S. pubescens* and var. *lancifolia* to full specific rank. A third variety, var. *longipes* Merr. & Chun, I consider a variety of *S. Henryi*.

In herbaria *S. sphenanthera* has been used in a collective sense for all the Chinese specimens of § *Pleiostema* with small flowers and comparatively few stamens. A population extending from Himalayan India across China to Formosa is to be considered in this complex. Although distinguishing characters of the several geographical segments are not very obvious when only a few specimens are examined, such characters do exist and they become apparent when an extensive series of specimens is available. Useful characters are to be sought in the leaves (shape, size, color, venation), the perianth-segments (shape), the stamens (number, position of thecae), the carpels (number, length of pseudostyle) and the seeds (surface configuration). On the basis of my observations I propose two new species in this complex, *S. neglecta* for the population extending from Yünnan into India (*S. elongata* of various authors), and *S. viridis* for the southeastern Chinese population. These two species and *S. sphenanthera* are not readily differentiated in a simple key, but their ranges, although contiguous, are essentially distinct.

13. **Schisandra** (§ *Pleiostema*) **neglecta** sp. nov.

Sphaerostema elongatum sensu Hook. f. & Thoms. Fl. Ind. **1**: 85, quoad specim. et descr. 1855; Walp. Ann. Bot. **4**: 79. 1857; Drury, Hand-book Ind. Fl. **1**: 648. 1864; non Bl.

Schizandra elongata sensu Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 44, exclud. basonym. 1872; King in Ann. Bot. Gard. Calcutta **3**: 220. *pl. 69, B.* 1891; Brandis, Indian Trees 9. 1906; Kanj., Kanj., & Das, Fl. Assam **1**: 27. 1935; non Baill.

Schisandra elongata sensu Schneid. Ill. Handb. Laubholzk. **1**: 341. 1905; Wilson in Jour. Arnold Arb. **7**: 238, p. p. 1926; non Baill.

Schizandra propinqua sensu Hand.-Maz. Symb. Sin. **7**: 245, p. p. 1931; non Baill.

Schisandra sp. Merr. in Brittonia **4**: 52, p. p. 1941.

Planta ut videtur dioica ubique glabra; ramulis subteretibus striatis vel rugulosis, hornotinis purpurascentibus 1.5–3 mm. diametro elongatis vel brevibus, annotinis fusco-cinereis 2–6 mm. diametro; squamis papyraceis suborbicularibus vel obovatis ad 15 × 10 mm. plerumque minoribus caducis; foliis 4–10 per ramulum hornotinum, petiolis 7–25 (–38) mm. longis, 0.8–1.5 mm. diametro; laminis papyraceis vel chartaceis in sicco supra fusco-olivaceis vel -viridibus subtus pallidioribus interdum subglaucis, ovato-lanceolatis vel oblongo- vel ovato-ellipticis raro lanceolatis, (5–) 6–12 cm. longis, (2–) 2.5–6.5 cm. latis, basi late obtusis vel attenuatis, in apicem 3–10 mm. longum calloso-apiculatum gradatim attenuatis vel cuspidatis, margine denticulatis (dentibus 1–3 per centimetrum) vel subintegris, costa supra plana vel subimpressa subtus prominente, nervis secundariis utrinsecus 4–6 arcuato-adscendentibus utrinque leviter elevatis vel subtus conspicuis, rete venularum utrinque subprominulo interdum supra plano subtus obvio; floribus basim ramulorum hornotinorum versus axillaribus vel in axillis bractearum fugacium enatis solitariis, bracteis secundariis interdum 1 vel 2 lanceolatis 2–3 mm. longis; floribus ♂: pedicellis gracilibus 0.3–1 mm. diametro sub anthesi 25–50 mm. longis ebracteolatis vel raro basim versus obscure bracteolatis; segmentis perianthii 6–8 subsimilibus, exterioribus papyraceis, interioribus subcarnosis, omnino late ellip-

ticis vel suborbicularibus vel late obovatis, maximis 5–10 × 4–9.5 mm. dorso interdum luteo-glandulosis, intimis raro ad 3.5 × 3 mm. reductis; androecio obovoideo vel subgloboso 3–7 mm. diametro, columna clavata inferne 1–2 mm. diametro estaminifera superne dilatata, pelta apicali (interdum nulla) irregulari 1–1.5 mm. diametro antheris semisterilibus 5–8 marginata; staminibus liberis 3- vel 4-seriatis 17–35, exterioribus 1.3–2.5 mm. longis, filamentis subteretibus 0.2–0.8 mm. longis, connectivo obovoideo-clavato 0.8–2 mm. longo superne 0.5–2 mm. lato interdum glanduloso subtruncato thecas subaequante vel paullo excedente, thecis introrso-lateralibus obliquis 0.7–1.7 mm. longis superne distantibus basi subcontiguis raro subparallelibus; floribus ♀: pedicellis ut ♂ similibus sed ad 60 mm. longis; segmentis perianthii ut ♂ similibus; gynoecio subgloboso sub anthesi 4–6 mm. diametro, columna cylindrica 1.5–1.7 mm. diametro, carpellis 4- vel 5-seriatis 26–45, ovario falcato-ellipsoideo 1.5–2.5 × 0.7–1 mm., cristis stigmatiferis angustis membranaceis erosulis in pseudostylum subulatum 0.3–0.9 mm. longum productis inferne in appendiculas oblongas ad 0.7 mm. longas extentis; pedicellis sub fructu ad 1.5 mm. diametro 25–80 mm. longis, toro leviter angulato gracili 0.8–3 mm. diametro maturitate 4–11 cm. longo; carpellis maturis plerumque 10–30 oblongo-ellipsoideis 5–8 × 4–5 mm., pericarpio saepe obscure glanduloso; seminibus complanato-ellipsoideis 3.2–4.5 × 2.8–4 × 2–2.7 mm., testa plerumque obvie rugulosa interdum lateraliter sublevi. FIG. 17, g.

TYPE LOCALITY: Mountains of A-wa-lo, northeast of Yeh-chih, east of the Mekong, northwestern Yünnan; *Rock 8933*, one of the best ♂ specimens available, is cited below as the type.

DISTRIBUTION: Yünnan to Himalayan India as far west as eastern Nepal, at altitudes usually recorded as 1300–2500 m., rarely to 3600 m., in a variety of habitats, such as mixed forests, woods, thickets, scrub, in ravines, etc. See map, *fig. 16.*

CHINA: YÜNNAN: Yung-shan Hsien, *H. T. Tsai 51168* (A); near K'un-ming, *H. v. Handel-Mazzetti 6089* (K); "Lamachang near Ngerya," border of Chung-tien [Hsien], *K. M. Feng 2844* (A); Ch'iao-t'ou on Yangtze, *K. M. Feng 3149* (A); "Tamichung," n. w. Li-chiang Hsien, *R. C. Ching 21484* (A); Wen-fang-tze, s. w. Li-chiang Valley, *R .C. Ching 21830* (A); Pin-ch'uan Hsien, *H. T. Tsai 52919* (A); Ta-li Hsien, *C. W. Wang 63435* (A); between Yangtze and Mekong Rivers, near "Schuba," *H. v. Handel-Mazzetti 8820* in part (A); "Alulaka," Mekong–Salwin divide, *T. T. Yü 19108* (A); mountains of A-wa-lo, n. e. of Yeh-chih, e. of the Mekong, *J. F. Rock 8933* (A TYPE, UC, US), June 1923; Yeh-chih, Wei-hsi Hsien, *C. W. Wang 68684* (A); Wei-hsi Hsien, *C. W. Wang 63549* (A), *63634* (A), *63997* (A), *64121* (A), *67622* (A), *H. T. Tsai 57875* (A), *59522* (A), *59827* (A), *59926* (A), *63107* (A); Lan-p'ing Hsien, *H. T. Tsai 53742* (A), *54053* (A); Salwin Valley, s. e. of Ch'ang-p'u-t'ung, *T. T. Yü 19132* (A); Chiu Chiang Valley (Taron), *T. T. Yü 19439* (A); hills east of T'eng-yüeh, *G. Forrest 7622* (K); Ho-shao Shan, Shunning Hsien, *T. T. Yü 16148* (A); Chien-shui Hsien, *H. T. Tsai 53052* (A); "Feng Chen Lin," south of Red River, *A. Henry 10697* (A, K, M, NY); Fo-hai (Meng-hai), *C. W. Wang 77299* (A), *74223A* (A); without definite locality, *E. E. Maire 3697* or s. n. (Man, UC), *G. Forrest 15825* (K), *H. T. Tsai 57316* (A), *57585A* (A), *57594A* (A), *57681* (A).

BURMA: SAGAING: Myitkyina: Adung Valley, *F. K. Ward 9443* (A); near Kang-fang, *C. W. D. Kermode 17289* (K).

INDIA: ASSAM: Khasi & Jaintia Hills District: Shillong, *C. B. Clarke 38603D* (US); "Myrong," *J. D. Hooker & T. Thomson* (K); Khasi region, *W. Griffith 77* (GH, K), *J. D. Hooker & T. Thomson,* July 1850 or without date (GH, K, NY), *C. B. Clarke 7325* (K). BENGAL: Sikkim: "Tonglo," *J. D. Hooker* (K); Sikkim without locality, *J. D. Hooker,* May 1849 or without date (GH, K, NY), *S. Kurz* (K); Darjeeling District: Lebong, *T. Anderson 350* (GH); vicinity of Darjeeling, *W. Griffith 76* (K); *T. Thomson* in 1857 (K), *J. S. Gamble 1890A* (K), *1891* (K), *C. B. Clarke 26715A* (K), *26752A* & *B* (K). NEPAL: Eastern Nepal, without detailed locality, *N. Wallich* (GH, K). INDIA without detailed data, *N. Wallich 4985c* (GH, K).

COLOR NOTES, etc.: Flowers at anthesis have been obtained between April and June, and collectors have recorded the flower-color variously, as yellow, yellowish green, orange-red, pale red, yellowish and red-tinged, etc. The most careful descriptions, such as some of Clarke's, indicate that the outer perianth-segments are green to yellow, the inner ones yellow, reddish toward base. Probably the flowers are similar to those of *S. sphenanthera* in color.

The red fruits are mature between July and October. Kanjilal et al. (in 1935) have recorded a local name in the Khasi region as *Soh-mijarian*.

SYNONYMY: The entity described above as new is the species which numerous writers on the Himalayan flora have referred to *S. elongata*, following a precedent first established by Hooker & Thomson in 1855. Handel-Mazzetti, among the specimens which he cited in 1931 as representing *S. propinqua*, included his no. *6089*, which clearly represents the entity in § *Pleiostema* here described.

There is no reason for the reference of the Himalayan–Yünnan material of § *Pleiostema* with comparatively small flowers to the very distinct Javanese *S. elongata*. The entity here under consideration is much more closely allied to the extensive Chinese population of *S. sphenanthera*, which it replaces to the west. That it has remained without a valid binomial up to the present, in spite of the numerous excellent specimens available, reflects on the neglect this genus has suffered, a fact already remarked by Dandy in Curtis's Bot. Mag. **147**: *tab. 8921*. 1938.

Characters which serve to separate *S. neglecta* from *S. sphenanthera* are summarized in my key to species and are briefly mentioned under the latter species. Other species of § *Pleiostema* with ranges which in part impinge upon that of *S. neglecta* are: *S. grandiflora, S. rubriflora, S. sphaerandra, S. Henryi, S. Wilsoniana,* and *S. lancifolia*. Of these, even if sterile material is under consideration, only *S. rubriflora* or *S. sphaerandra* could be confused with the new species. Careful comparison with an adequate suite of specimens should permit the separation of sterile material, and of course either ♂ or ♀ flowers or fruits permit ready identification of *S. neglecta*.

The westernmost record of *S. neglecta* appears to be the Wallich collection cited above as coming from "eastern Nepal." This locality, of course, cannot be accurately shown on my distribution map (*fig. 16*), but it is apparent that both *S. grandiflora* and *S. propinqua* extend farther west in the Himalayas than does *S. neglecta*.

14. **Schisandra** (§ *Pleiostema*) **viridis** sp. nov.

Schizandra elongata var. *longissima* Dunn in Jour. Linn. Soc. Bot. **38**: 354, p. p. 1908.

Schisandra sphenanthera sensu Rehder & Wilson in Jour. Arnold Arb. **8**: 110. 1927; Cheng in Contr. Biol. Lab. Sci. Soc. China **8**: 138. 1932, **9**: 283. 1934; non Rehder & Wilson (1913).

Schizandra sphenanthera sensu Merr. & Chun in Sunyatsenia **1**: 57. 1930.

Planta ut videtur dioica ubique glabra; ramulis subteretibus paullo rugulosis, hornotinis brunneo-purpurascentibus 1–4 mm. diametro elongatis vel brevibus, annotinis cinerascentibus 2–5 mm. diametro; squamis papyraceis suborbicularibus ad 3 mm. longis (vel ultra?) fugacibus; foliis 3–10 (–15) per ramulum hornotinum, petiolis 15–30 (–35) mm. longis, 0.7–1.5 mm. diametro; laminis papyraceis saepe translucentibus et pellucido-punctatis in sicco supra olivaceis vel viridibus raro fuscis subtus haud pallidioribus ovato-ellipticis vel raro-lanceolatis, (4–) 6–14 (–16) cm. longis, (2–) 3.5–7 (–8) cm. latis, basi obtusis vel acutis, in apicem 5–20 mm. longum paullo incrassatum saepe gracilem attenuatis, margine obvie serrulatis vel undulato-denticulatis (dentibus 1 vel 2 per centimetrum), costa supra plana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 3–6 arcuato-adscendentibus supra prominulis subtus plerumque valde elevatis, rete venularum intricato utrinque evidenter prominulo; floribus solitariis axillaribus vel basim ramulorum hornotinorum versus in axillis bractearum fugacium enatis, bracteis secundariis basalibus 1 vel 2 ad 2 mm. longis evanescentibus; floribus ♂: pedicellis gracilibus 0.3–1 mm. diametro sub anthesi 15–50 mm. longis ebracteolatis; segmentis perianthii 6–8 subsimilibus vel extimo intimisque paullo

reductis, ommino tenuiter carnosis late ellipticis vel obovatis vel suborbicularibus, maximis 5–10 × 4–10 mm., intimo raro ad 4 × 3 mm. reducto; androecio obovoideo vel subgloboso 3–6.5 mm. diametro, columna clavata inferne 1–2 mm. diametro estaminifera superne incrassata, pelta apicali 1.5–3 mm. diametro antheris 3–10 semisterilibus composita; staminibus liberis 1–3-seriatis 10–20, exterioribus 1.2–2.2 mm. longis, filamentis minutis ad 0.6 mm. longis vel subnullis, connectivo oblongo-clavato 1–2 mm. longo superne 0.5–1.5 mm. lato obscure glanduloso thecas plerumque excedente, thecis introrso-lateralibus 0.7–1.5 mm. longis; floribus ♀: pedicellis ut ♂ similibus sed 40–70 mm. longis; segmentis perianthii ut ♂ similibus; gynoecio subgloboso sub anthesi 5–6 mm. diametro, columna cylindrica 1.5–1.8 mm. diametro, carpellis circiter 25 et 3-seriatis, ovario subfalcato-ellipsoideo-obovoideo 1.8–2.5 × 0.8–1.2 mm. basi angustato, cristis stigmatiferis membranaceis eroso-ciliolatis angustis in pseudostylum inconspicuum ad 0.2 mm. longum productis inferne in appendiculam oblongam saepe elongatam extentis; pedicellis sub fructu gracilibus 35–95 mm. longis, toro leviter angulato 1–3 mm. diametro maturitate 6.5–11.5 cm. longo; carpellis maturis plerumque 15–20 ellipsoideis 7–12 × 5.5–9 mm., pericarpio inconspicue luteo-glanduloso; seminibus 2 (raro 1) complanato-ellipsoideis 3.5–4.5 × 3–3.8 × 2.5–2.8 mm., testa ubique valde rugulosa vel subtuberculata.

TYPE LOCALITY: Ho-yüan Hsien, central Kwangtung; *Tsang 28783*, the best ♂ specimen available, is designated as the type.

DISTRIBUTION: Eastern and southeastern China, from Chekiang and southern Anhwei southwestward to Kwangtung, northern Kwangsi, and Kweichow, at altitudes of 250–1200 m. (up to 1500 m. in Chekiang according to Cheng). See map, *fig. 22*. Various recorded habitats include woods, forests, thickets, brushy slopes, ravines, along streams, etc.

CHINA: ANHWEI: T'ien-chu Shan, Chien-shan Hsien, *C. S. Fan & Y. Y. Li 221* (A); Li-kan, w. Ch'i-men Hsien, *R. C. Ching 3166* (A, K, UC). CHEKIANG: Yin Hsien, *Y. Y. Ho 1138* (A); T'ien-mu Shan, *R. C. Ching 5132* (A); w. T'ien-mu Shan, *H. H. Hu 1693* (A, UC); e. T'ien-mu Shan, *H. H. Hu 1584* (A, UC); Ch'ang-hua Hsien, *Y. L. Keng 601* (A, UC); "Ga Fong Kong, Chen Chion," 120 li s. of Hsien-chü, *R. C. Ching 1781* (A, UC, US); without definite locality, *R. C. Ching 4777* (A), *S. Chen 293* (A), *3258* (A), *Y. Y. Ho 1448* (A). FUKIEN: Near "Buong Kang," vicinity of Yen-p'ing, *S. T. Dunn 2442* (cotype coll. of *S. elongata* var. *longissima* in part, A, K); without locality, *S. T. Dunn 2330* (A). KIANGSI: Ku-ling, *E. H. Wilson 1726* (A, US); Lu Shan, *N. K. Ip 1589* (K), *H. H. Chung & S. C. Sun 732* (A, NY); from Lien-hua-dong to Ku-ling, Lu Shan, *Y. Tsiang 10679* (NY); Huang-yen-ssu, Lu Shan, *A. N. Steward 1031* (UC), *H. C. Cheo 126* (K); Ta-lou Shan, Feng-ch'eng Hsien, *Y. Tsiang 10362* (NY); Hsin-feng Hsien, *H. H. Hu 1118* (A); Sai-hang-cheung, near Tung-lei Village, Ch'ien-nan Hsien, *S. K. Lau 4027* (A, US); "Hong San," s. Kiangsi, *J. L. Gressitt 1485* (A, M); without definite locality, *K. K. Tsoong 3432* (Man). HUNAN: "Southern Hunan," *S. S. Sin 238* (K). KWEICHOW: Wong-kwan-chou, Hsing-jen Hsien, *S. W. Teng 90255* (A). KWANGTUNG: Yam-na [Yit-nga] Shan, Mei [Chia-ying] Hsien, *W. T. Tsang 21423* (A, K, NY); Nam Shan, Ts'ung-shue Village, Ho-yüan Hsien, *W. T. Tsang 28783* (A TYPE), May 1938; Lo-ch'ang, *C. L. Tso 20374* (K, NY); Yao Shan, North River, *S. S. Sin 9436* (NY); Tsing-wan Shan, Wong-chuk-i and vicinity, Weng-yüan Hsien, *S. K. Lau 1993* (A); Ju-yüan Hsien, *S. P. Ko 52691* (A), *52919* (A); vicinity of Yang-shan, s. of Lien Hsien (Linchow), *T. M. Tsui 825* (A, NY); Lung-t'au Mt., Iu Village, *K. P. To, W. T. & U. K. Tsang 533* (C. C. C. 12532) (UC, US). KWANGSI: Pai-yun-an and vicinity, Ch'üan Hsien, *W. T. Tsang 27641* (A, US), *27693* (A, US); "Chuen Yuen," *T. S. Tsoong* [*Z. S. Chung*] *82002* (A); Yao Shan [Kwangsi or Kwangtung?], *S. S. Sin 8221* (K).

LOCAL NAMES and COLOR NOTES: Two names recorded from Kwangtung are: *Chau-fan-tuen-tang* (by Tsang, for the type) and *Ho-t'ang* (by To et al.). The perianth-segments are yellow to greenish (apparently without the reddish or orange tinge within as in the two preceding species), and anthesis occurs in May or June. The fruits, which are mature from July to September, are red or scarlet.

SYNONYMY: As I have already mentioned under *S. Henryi* var. *typica*, Dunn's trinomial *S. elongata* var. *longissima* is a mixed concept; the two Fukien specimens listed by Dunn doubtless belong in *S. viridis*, and one of them is cited above. The references to *S. sphenanthera*

listed above are based on specimens from Anhwei, Chekiang, and Kwangtung which fall into my concept of the new species.

Schisandra viridis takes the place of *S. sphenanthera* in southeastern China; in general it occurs at lower elevations. Some difficulty may be encountered in identifying specimens from the contiguous peripheries of the two ranges, which overlap slightly at least in Anhwei; but I believe that the combinations of characters used in my key to the species are fairly obvious. Foliage differences between these two species are quite definite and are supplemented by differences in position of thecae, number of carpels, and surface of seeds. A glance at the citation of specimens above will indicate to what a remarkable extent Chinese collectors have enriched our knowledge of the flora of southeastern China in the last ten or fifteen years.

Two specimens, not listed above, which are probably referable to *S. viridis* are *Steward & Cheo 211* (A, NY) and *213* (A), from Ling-yün Hsien, Kwangsi. The first of these has ♂ flowers more or less normal for the species but with slightly larger perianth-segments than usual. The second is apparently an abnormal form, with about 13 perianth-segments considerably longer than usual, the largest being up to 13 mm. long. The free stamens of no. *213* are about 32 in number, whereas in other material of *S. viridis* no more than 20 free stamens have been observed. The free filaments of the outer stamens in no. *213* are sometimes 1.5 mm. long, much longer than otherwise observed in the species. In foliage these two Kwangsi specimens are quite indistinguishable from typical material of *S. viridis*. It is possible that future material of ♀ flowers or fruits from the same locality will permit the nomenclatural recognition of this form, but for the time being I am inclined to believe that the two specimens are somewhat abnormal.

15. **Schisandra** (§ *Pleiostema*) **arisanensis** Hayata, Ic. Pl. Formos. **5:** 1. *pl. 1*, as *Schizandra a.* 1915.

Schizandra arisanensis Hayata, Ic. Pl. Formos. **9:** 4. 1920; Sasaki, Cat. Gov. Herb. (Taihoku) 217. 1930; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 358. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 241. 1936.

Apparently dioecious, glabrous throughout; branchlets subterete, rugulose-striate, usually short when fertile, the young ones brownish-purpurascent, 1.5–2 mm. in diameter, the older ones cinerascent or brownish, 2–4 mm. in diameter; bud-scales papyraceous, suborbicular, usually 2–3 mm. long, fugacious; leaves usually 3–5 per annual shoot; petioles 8–15 mm. long, 0.5–1 mm. in diameter; leaf-blades papyraceous, when dried usually brownish above and somewhat paler beneath, ovate-lanceolate or oblong-ovate, (4–) 5–9 (–10.5) cm. long, (1.5–) 2–4 (–5.5) cm. broad, acute to attenuate at base (rounded in some juvenile leaves), gradually narrowed at apex to a callose-apiculate acumen 5–15 mm. long, denticulate at margin with 1 or 2 teeth per centimeter, the costa impressed above, prominent beneath, the secondary nerves 4–7 per side, arcuate-ascending, prominulous above, somewhat elevated beneath, the veinlet-reticulation prominulous on both sides; ♂ flowers: pedicels slender, usually 0.4–1 mm. in diameter, 20–50 mm. long at anthesis, ebracteolate; perianth-segments 2- or 3-seriate, 6 or 7, all essentially similar, papyraceous to thin-carnose, with conspicuous yellow glands, broadly elliptic to obovate, the largest ones 9–10 × 6–9 mm., the outermost ones sometimes ciliolate, the inner few slightly reduced to 6.5–8 × 3–5 mm.; androecium obovoid, 4–6 mm. in diameter, the column 1.5–2 mm. in diameter, free of stamens proximally, the apical shield small or lacking, the free stamens about 3-seriate, 18–20, the lower ones with ligulate filaments 0.5–1.5 mm. long, the connective obovoid, 1.5–2 mm. long, 0.8–1.5 mm. broad at the truncate or sub-

emarginate apex, copiously yellow-glandular, slightly exceeding the thecae, the thecae introrse-lateral, 1.3–2 mm. long, oblique, contiguous at base; ♀ flowers and fruits not seen, the following data from the original descriptions: perianth of ♀ flowers essentially as the ♂; gynoecium ellipsoid, about 6.5 mm. long, the column cylindric, about 2 mm. in diameter, the carpels numerous [about 60 in plate], obovoid or ellipsoid, obliquely stigmatiferous distally, the pseudostyle obvious; fruit 10–15 cm. long (including pedicel?), the carpels subglobose, about 8 mm. in diameter, the seeds globose-reniform, about 4.5 × 3.5 mm., the testa crustaceous, muricate.

TYPE LOCALITY: Formosa: "Mt. Arisan: inter Funkiko et Taroyen, leg. R. KANEHIRA, B. HAYATA et I. TANAKA, Aprili. 1914." I have not seen a duplicate of the type, but the Gressitt specimen cited below is an excellent match for the original description and plate.

DISTRIBUTION: Formosa, at fairly high elevations (2300 m. according to Gressitt). Sasaki gives several localities for the species other than Mt. Arisan. See map, *fig. 22.*

FORMOSA: Mt. Arisan, *J. L. Gressitt 190* (A, K, NY), *E. H. Wilson 9826* (A) (juvenile?).

COLOR NOTES, etc.: Gressitt mentions the flowers as red, while Hayata describes the outer perianth-segments as greenish yellow, the inner segments and the stamens as reddish. Flowering material has been obtained in April and May and fruiting material in August.

Schisandra arisanensis is another species of the immediate alliance of *S. sphenanthera.* It seems amply distinguished as a species by a combination of characters, including its comparatively narrow leaf-blades with prominulous veinlet-reticulation, its numerous carpels, and its seeds with the testa "muricate" [ex Hayata].

16. **Schisandra** (§ *Pleiostema*) **gracilis** sp. nov.

Planta ut videtur dioica ubique glabra; ramulis subteretibus vel leviter angulatis fusco-purpurascentibus, hornotinis brevibus gracilibus, annotinis 2–3 mm. diametro; squamis papyraceis suborbicularibus ad 3 mm. longis caducis; foliis 2–4 per ramulum hornotinum subaggregatis, petiolis gracilibus (0.7–1 mm. diametro) 10–15 mm. longis; laminis papyraceis in sicco utrinque olivaceis late ovatis, 4–5.5 cm. longis, 3–4 cm. latis, basi rotundatis vel late obtusis et in petiolum subito decurrentibus, in apicem circiter 5 mm. longum paullo incrassatum abrupte cuspidatis, margine inconspicue denticulatis (dentibus 2 vel 3 per centimetrum), costa supra plana vel basim versus impressa subtus prominente, nervis secundariis utrinsecus 3 vel 4 arcuato-adscendentibus supra paullo subtus valde elevatis, rete venularum intricato utrinque prominulo; floribus solitariis in axillis bractearum obovatarum ad 12 mm. longarum fugacium enatis; floribus ♂: pedicellis gracillimis 0.3–0.8 mm. diametro sub anthesi 20–25 mm. longis ebracteolatis; segmentis perianthii 8 vel 9, exterioribus 2 membranaceis vel papyraceis deltoideo-suborbicularibus obscure ciliolatis 1.5–4 × 2–2.5 mm., maximis carnosis suborbicularibus vel late ellipticis, 5.5–7.5 × 5–6 mm., intimis incrassatis oblongo-obovatis 3.5–4 × 2.5–3 mm.; androecio obovoideo 4.5–5 mm. diametro, columna clavata basi 1–1.5 mm. diametro estaminifera superne incrassata, pelta apicali circiter 2 mm. diametro antheris 5 vel 6 semisterilibus composita; staminibus liberis 10–13 circiter 2-seriatis, exterioribus circiter 2.5 mm. longis, filamentis subteretibus ad 0.7 mm. longis vel subnullis, connectivo oblongo-obovoideo 1.5–2 mm. longo superne 1–1.3 mm. lato minute glanduloso apice rotundato et thecas conspicue excedente, thecis introrso-lateralibus 0.8–1.2 mm. longis; floribus ♀ et fructibus non visis.

TYPE LOCALITY: Mogok, central Burma, collected without detailed data as to habitat, altitude, and flower-color.

DISTRIBUTION: Known only from the type. See map, *fig. 23.*

BURMA: SAGAING: Katha District: Mogok, *F. G. Dickason 5016* (A TYPE), May 1934.

Although the entity discussed above is known only from a rather inadequate specimen, without ♀ flowers or fruits, I venture to describe it as new, since it cannot be referred to any known species. Superficially it suggests the Yünnan material described below as *S. micrantha,* but it differs in having its two outermost perianth-segments distinctly reduced and bracteole-like rather than all the segments essentially similar, in having its largest perianth-segments distinctly larger, and in having its androecium larger throughout. The connectives of the stamens of *S. gracilis* are conspicuously extended beyond the thecae distally, being of a type which suggests *S. Henryi,* from which, of course, numerous characters pertaining to branchlets, foliage, and flower-parts widely remove it.

17. **Schisandra** (§ *Pleiostema*) **lancifolia** (Rehder & Wilson) comb. nov.

Schisandra sphenanthera var. *lancifolia* Rehder & Wilson in Sargent, Pl. Wils. **1:** 415. 1913; Rehder, Man. Cult. Trees and Shrubs 260. 1927, ed. 2. 254. 1940.

Schizandra sphenanthera var. *lancifolia* Rehder & Wilson ex Rehder in Bailey, Stand. Cycl. Hort. **6:** 3111. 1917; Bean, Trees and Shrubs Brit. Isles **3:** 454. 1933.

Schisandra sphenanthera sensu Wilson in Jour. Arnold Arb. **7:** 237. 1926; non Rehder & Wilson.

Slender, glabrous throughout, apparently dioecious; branchlets subterete, brownish, often striate, sometimes irregularly suberose-costate with subpersistent corky ribs, the young ones short or elongate, 1–3 mm. in diameter, the older ones 1.5–4 mm. in diameter; bud-scales papyraceous, ovate-deltoid, subacute, up to 5 mm. long, caducous; leaves 4–11 per annual shoot; petioles sometimes faintly suberose-margined, 3–15 mm. long, 0.7–1 mm. in diameter; leaf-blades papyraceous to submembranaceous when dried and usually greenish on both sides, lanceolate or narrowly elliptic, (3–) 4–10 cm. long, 1–3 (–3.5) cm. broad, attenuate or acute at base, gradually attenuate or cuspidate at apex (acumen up to 15 mm. long, callose-apiculate), inconspicuously denticulate at margin with 2 or 3 teeth per centimeter, the principal nerves often yellowish, the costa plane or slightly impressed above, elevated beneath, the secondary nerves 4–6 per side, sharply ascending, usually plane above and slightly raised beneath, the veinlet-reticulation intricate, plane above and prominulous beneath; flowers with 1 or 2 secondary subtending bracts, these lanceolate, minute, evanescent; ♂ flowers: pedicels slender, 0.2–0.7 mm. in diameter, 18–50 mm. long at anthesis, ebracteolate; perianth-segments 6–8, about 2-seriate, all essentially similar, submembranaceous to thin-carnose, scariose-margined, elliptic to suborbicular, (2.5–) 3.5–5.5 × (2.5–) 3–6 mm.; androecium obovoid, 2.5–3.5 mm. high, the column terete or obconical, 0.5–1.5 mm. in diameter, essentially staminiferous to base, without undifferentiated apical tissue, the stamens 10–16, all free but the upper ones often very small, the lower ones with short subterete filaments 0.2–0.5 mm. long, the connective oblong, obscurely glandular, subequal to thecae, the thecae introrse-lateral 0.6–1.3 mm. long, subparallel; ♀ flowers: pedicels as in ♂ flowers but 30–60 mm. long at anthesis; perianth-segments as in ♂ flowers; gynoecium ellipsoid, the column 1.5–3.5 mm. long and 1.4–2 mm. in diameter, the carpels 16–23, the ovary falcate-ellipsoid or -ovoid, 1.7–3 × 0.9–1.3 mm., the stigmatic crests produced into an inconspicuous pseudostyle 0.5–1 mm. long, irregularly expanded proximally into a free flattened appendage; fruiting pedicels slender, not more than 1 mm. in diameter, 35–70 mm. long at maturity; the torus faintly angled, 1–3 mm. in diameter, 3–7 cm. long, usually with 8–15 maturing carpels; carpels ellipsoid, 7–9 × 5–6 mm., the seeds ellipsoid-flattened, 3.4–3.8 × 3–3.5 × 2.5–2.7 mm., the hilar indentation slight, the testa very obscurely and distantly rugulose. FIG. 17, a–c.

TYPE LOCALITY: Mu-pin, western Szechuan; *Wilson 2552,* cited below, is the type.

DISTRIBUTION: Western Szechuan, adjacent Sikang, and northwestern Yünnan, at alti-

tudes of 1200–3000 m., in thickets or woods, on rocky slopes, along streams, etc. See map, *fig. 23.*

CHINA: "Western China," *E. H. Wilson 3134* (A, K). SZECHUAN: Mu-pin, *E. H. Wilson 2552* (A TYPE, K, US); Ta-hsiang-ling, *C. Y. Chiao 1611* (A); Yüeh-sui Hsien, *T. T. Yü 1047* (A); Mien-ning Hsien, *T. T. Yü 1771* (A); between "Ssu queh pa" and "Chao kio," *C. Schneider 985* (A, K), *999* (A, GH, K); "Daliang-schan . . . inter Tjiaodjio et Lemoka," e. of Ning-yüan, *H. v. Handel-Mazzetti 1611* (K). SIKANG: Vicinity of K'ang-ting (Ta-chien-lu), *J. A. Soulié 453* (K), *E. H. Wilson 1268* (A, K, US), *1268a* (A, K, US). YÜNNAN: Li-chiang Hsien, *C. W. Wang 71297* (A); eastern slopes of Li-chiang Snow Range, *J. F. Rock 4299* (A, NY, UC, US); southwest of the Yangtze bend at Shih-ku, *J. F. Rock 9602* (A, NY, UC, US), *9603* (A, UC, US); Wei-hsi Hsien, *C. W. Wang 63595* (A); Chien-ch'uan-Mekong divide, *G. Forrest 21524* (A, K, US); Ta-li Hsien, *C. W. Wang 63372* (A); Chen-k'ang Hsien, *C. W. Wang 72496* (A); western Yünnan,

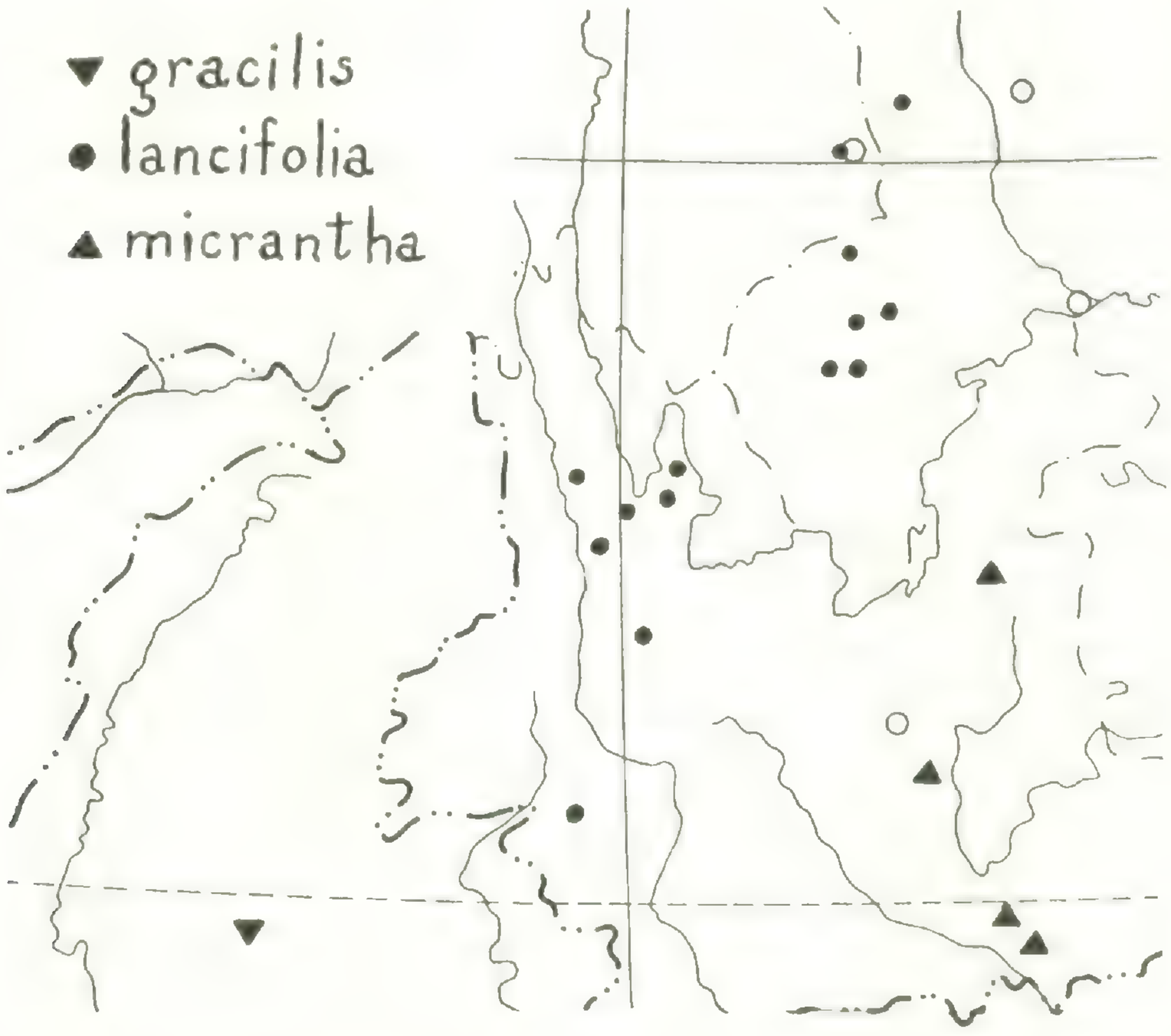

FIG. 23. Approximate known distribution of *Schisandra gracilis, S. lancifolia,* and *S. micrantha.*

Herb. H. D. McLaren L.106A (K); without definite locality, *G. Forrest 10197* (A, K), *16589* (A, K).

COLOR NOTES: Mature flowers have been obtained from May to July, and collectors report them as yellow, yellowish white, orange-yellow, yellow with a pink tinge, or red. It seems probable that the outer segments are the palest and the inner ones increasingly reddish, as in *S. sphenanthera* and some of its relatives. The red or scarlet fruits mature from August to November.

SYNONYMY: In 1926 Wilson referred to *S. sphenanthera* three Rock collections which clearly represent *S. lancifolia.*

The entity discussed above appears to me far too distinct to be included in the same specific concept as typical *S. sphenanthera.* It is of interest that Bean (in 1933) observed that the variety is "well distinguished . . . appears distinct enough to rank as a species." *Schisandra lancifolia* and *S. micrantha* appear to form a well marked species-group in § *Pleiostema,* characterized by the small size

of all their floral parts, a reduced number of stamens and carpels, a short and slender fruit, and comparatively small leaves.

18. **Schisandra** (§ *Pleiostema*) **micrantha** sp. nov.

Planta gracilis ubique glabra ut videtur dioica; ramulis teretibus vel inconspicue costatis saepe rugulosis, hornotinis fusco-stramineis 0.8–2 mm. diametro elongatis vel brevibus, annotinis fusco-purpurascentibus vel cinereis 1.5–3 mm. diametro; squamis pluribus papyraceis late ovatis plerumque 2–4 mm. longis caducis; foliis 5–10 (–15) per ramulum hornotinum, petiolis 7–20 (–25) mm. longis gracilibus (0.5–1 mm. diametro); laminis in sicco papyraceis vel submembranaceis supra plerumque fusco-viridibus subtus paullo pallidioribus, ovatis vel deltoideo-ovatis vel late ellipticis, (3–) 4–7 (–8) cm. longis, (1.5–) 2–6 (–6.5) cm. latis, basi obtusis vel rotundatis, in apicem 2–8 mm. longum calloso-apiculatum cuspidatis, margine subintegris vel denticulatis (dentibus 1 vel 2 per centimetrum), costa supra leviter subtus valde elevata, nervis secundariis utrinsecus 3 vel 4 arcuato-adscendentibus supra prominulis subtus paullo elevatis, rete venularum supra plano subtus prominulo; floribus solitariis basim ramulorum hornotinorum versus in axillis foliorum vel bractearum fugacium enatis, bracteis secundariis basalibus 1 vel 2 deltoideis ad 1 mm. longis evanescentibus; floribus ♂: pedicellis gracillimis 0.2–0.6 mm. diametro sub anthesi 15–30 mm. longis raro basim versus inconspicue unibracteolatis; segmentis perianthii 7 vel 8 subsimilibus 2- vel 3-seriatis papyraceis vel tenuiter carnosis suborbicularibus vel late ellipticis, maximis 4–6 × 2.5–6 mm., intimis 2 vel 3 obovatis ad 3–4 × 2.5–4 mm. reductis; androecio obovoideo 2.5–3.5 mm. diametro, columna subclavata inferne 0.6–1 mm. diametro estaminifera superne incrassata, pelta apicali ad 1 mm. diametro antheris 3 vel 4 conglomeratis composita; staminibus liberis 1- vel 2-seriatis 8–12 exterioribus 1–1.3 mm. longis, filamentis subteretibus ad 0.5 mm. longis, connectivo obovoideo saepe obscure glandulosos 0.7–1 mm. longo, 0.4–0.7 mm. lato apice subtruncato thecas subaequante, thecis introrso-lateralibus 0.5–1 mm. longis; floribus ♀: pedicellis ut ♂ similibus ad 40 mm. longis; segmentis perianthii ut ♂ similibus; gynoecio subgloboso sub anthesi 2.5–4 mm. diametro, columna 1–1.5 mm. diametro, carpellis 3- vel 4-seriatis 16–21, ovario falcato-obovoideo 1.2–2 mm. longo, cristis stigmatiferis inconspicuis in pseudostylum subulatum 0.3–0.6 mm. longum productis inferne in appendiculas irregulares oblongas extentis; pedicellis sub fructu gracilibus 20–50 mm. longis, toro gracili 0.7–1.5 mm. diametro maturitate 1.5–4 cm. longo; carpellis maturis 5–15 oblongo-ellipsoideis 6–8 × 4.5–6 mm., pericarpio obscure glanduloso; seminibus complanato-ellipsoideis 3.3–4 × 3–3.5 × 2.5–2.7 mm., testa minute sed obvie rugulosa.

TYPE LOCALITY: P'ing-pien Hsien,[1] southeastern Yünnan; *Tsai 55161*, the best ♂ specimen available, is designated as the type.

DISTRIBUTION: Eastern and southeastern Yünnan, at altitudes of 1200–2900 m., often collected on slopes or in ravines by streams. See map, *fig. 23*.

CHINA: YÜNNAN: Che-hai, *E. E. Maire 177* (A), *396* (A); Huang-t'u-p'u, Ch'eng-chiang, *H. Wang 41426* (A); Meng-tzu, *A. Henry 11211* (A, K, NY, US); P'ing-pien Hsien, *H. T. Tsai 55161* (A TYPE), May 17, 1934, *55493* (A), *60136* (A); "La-Kou," *E. E. Maire 33* (A); without definite locality, *F. Ducloux 735* (K).

[1] The Chinese collector H. T. Tsai has made large collections of great importance in Yünnan, much of his material coming from the southern part of the province, which is otherwise known principally from Henry's material from the Meng-tzu and Ssu-mao regions. One of Tsai's localities which may have puzzled students of this region is "Ping-pien Hsien," where he obtained some hundreds of very important specimens. This locality will be sought in vain on maps of Yünnan. In the Gazetteer of Chinese Place Names based on the V. K. Ting Atlas it appears as "Ching-pien" Hsien, which in a supplement is corrected to the preferred spelling of "P'ing-pien" Hsien, at lat. 22°54′ and long. 103°40′, somewhat southeast from Meng-tzu. Tsai's collections from P'ing-pien Hsien will be found cited throughout this paper, and they invariably offer very critical material.

COLOR NOTES: The flowers, at anthesis from May to July, are variously recorded as yellowish, pinkish yellow, pale yellowish orange, and red. As in other species of this general alliance, the perianth doubtless becomes deeper in color toward the inner segments. Fruits have been collected in August.

The entity described above, with a compact geographical range to the southeast of that of *S. lancifolia,* appears excellently marked. In its general floral characters it agrees well with the preceding species, but in foliage it differs rather conspicuously. The new species represents an extreme in § *Pleiostema* by sometimes having as few as 8 free stamens.

19. **Schisandra** (§ *Maximowiczia*) **chinensis** (Turcz.) Baill. Hist. Pl. **1:** 148, as *Schizandra c.* 1868–69; K. Koch, Dendr. **1:** 386. 1869; Lauche, Deutsche Dendr. 360. *f. 140.* 1880; Dippel, Handb. Laubholzk. **3:** 156. *f. 82.* 1893; Schneid. Ill. Handb. Laubholzk. **1:** 341. *f. 218, a. 219, a–i.* 1905; Silva Tarouca, Freil.-Laubgeh. 343. 1913; Rehder in Jour. Arnold Arb. **5:** 147. 1924, Man. Cult. Trees and Shrubs 260. 1927, ed. 2, 254. 1940.

Kadsura chinensis Turcz. in Bull. Soc. Nat. Mosc. **1837** (7)**:** 149. 1837; Rupr. in Maxim. in Bull. Phys.-Math. Acad. Sci. St. Pétersb. **15:** 143. 1856 [repr. in Mél. Biol. **2:** 440. 1856].

Sphaerostemma japonica (sic) Sieb. & Zucc. in Abh. Bayer. Akad. Wiss. Math. Phys. Cl. **4** (2)**:** 188, nomen. 1845 [Fl. Jap. Fam. Nat. **1:** 80].

Maximowiczia amurensis Rupr. in Maxim. in Bull. Phys.-Math. Acad. Sci. St. Pétersb. **15:** 124. 1856 [repr. in Mél. Biol. **2:** 412. 1856].

Maximowiczia chinensis Rupr. ex Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Etrang. **9:** 31. *tab. 1.* 1859; Regel in Gartenflora **11:** 406. *tab. 382, f. 2, 3.* 1862, in Viestn. Ross. Obshch. Sad. **1862:** 405. *pl. 108.* 1862; Planchon in Fl. Serr. et Jard. **15:** 175. *pl. 1594.* 1865; Morren & de Vos, Ind. Bibl. Hort. Belg. 437. 1887.

Sphaerostema japonicum A. Gray in Mem. Am. Acad. n. s. **6:** 380. 1859.

Schizandra japonica Sieb. & Zucc. ex A. Gray in Mem. Am. Acad. n. s. **6:** 380, as synonym. 1859.

Maximowitzia chinensis Rupr. ex Baill. Hist. Pl. **1:** 148, as synonym. 1868–69.

Maximowitschia amurensis Rupr. ex K. Koch, Dendr. **1:** 386, as synonym. 1869.

Maximowitschia chinensis Rupr. ex K. Koch, Dendr. **1:** 386, as synonym. 1869.

Maximowitschia japonica A. Gray ex K. Koch, Dendr. **1:** 386, as synonym. 1869.

Schizandra chinensis Baill. ex Franch. & Sav. Enum. Pl. Jap. **1:** 17. 1873; Hemsl. in Garden **8:** 271. 1875; Laval. Arbor. Segrez. 9. 1877, Ic. Sel. Arbor. et Frutic. Hort. Segrez. *tab. 26* (excl. *f. 6–8*). 1882; Forbes & Hemsl. in Jour. Linn. Soc. Bot. **23:** 25, p. p. 1886; Nichols. Ill. Dict. Gard. **3:** 383. 1887; Prantl in E. & P. Nat. Pfl. III. **2:** 18. 1888; Tanaka, [Illustr. Useful Pl.] *f. 402.* 1891; Koehne, Deutsche Dendr. 149. *f. 28, A–H.* 1893; Tanaka, Useful Pl. Jap. 109. 1895; Parment. in Bull. Sci. Fr. & Belg. **27:** 235, 309. 1896; Rehder in Bailey, Cycl. Am. Hort. **4:** 1625. 1902; Beissn., Schelle, & Zabel, Handb. Laubh.-Benen. 102. 1903; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 49, p. p. 1905 [repr. Contr. Fl. As. Or. **2:** 49. 1907]; Nakai in Jour. Coll. Sci. Tokyo **26:** 38. 1909; Anon. in Gard. Chron. III. **50:** 2. *f. 1.* 1911; Matsum. Ind. Pl. Jap. **2** (2)**:** 96. 1912; Bean, Trees and Shrubs Brit. Isles **2:** 504. 1914; Miyabe & Miyake, Fl. Saghalin 25. 1915; Meyer in U. S. Bur. Pl. Industr. Pl. Immigr. **107:** 866. 1915, **116:** *f.* (opp. p. 950). 1915; Rehder in Bailey, Stand. Cycl. Hort. **6:** 3110. 1917; Mori, Enum. Pl. Corea 165. 1922; Leray in Rev. Hort. **97:** 449. 1925; Hooper in Gard. Bull. Straits Settlem. **6:** 129. 1929; ? Crevost & Pételot in Bull. Econ. Indochine **32:** 22. 1929; Darnell in Hardy and Half-hardy Pl. **1:** 215. *f.* 1930; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 358. 1931; Otani in Jour. Jap. Bot. **8:** (139). *pl.* 1932; Nakai, Fl. Sylv. Koreana **20:** 103. *tab. 20.* 1933; ? Burkill, Dict. Econ. Prod. Mal. Penins. 1975. 1935; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 241. 1936; Kitagawa, Lineam. Fl. Manshur. 231. 1939; Sugawara, Ill. Fl. Saghalien **2:** 949. *tab. 443.* 1939.

Maximowiczia sinensis [W. Robinson] in Garden **6:** 583. *f.* 1874; Rupr. ex Rehder in Bailey, Cycl. Am. Hort. **4:** 1625, as synonym. 1902.

Maximowiczia japonica A. Gray ex Lauche, Deutsche Dendr. 360, as synonym. 1880.

Polycarpa Maximowiczi sensu Morren & de Vos, Ind. Bibl. Hort. Belg. 437, as synonym. 1887; non Linden ex Carr.

Idesia polycarpa sensu Morren & de Vos, Ind. Bibl. Hort. Belg. 437, as synonym. 1887; non Maxim.

Schizandra chinensis var. *glabrata* Nakai ex Mori, Enum. Pl. Corea 166. 1922; Nakai, Fl. Sylv. Koreana **20:** 106. 1933.

Schizandra chinensis var. *typica* Nakai, Fl. Sylv. Koreana **20:** 105. 1933; Sugimoto, Key Trees and Shrubs Japan 87. 1936.

Monoecious or apparently often dioecious, glabrous throughout except for lower surfaces of leaves; young branchlets brownish or purpurascent, subterete or striate-rugulose, 0.8–2.5 mm. in diameter, the older ones becoming cinereous, subterete, often rugulose, 2–5 mm. or more in diameter; bud-scales few, oblong, obtuse, the largest ones up to 6 × 6 mm., usually fugacious; leaves alternate (on annual shoots when elongate) or subverticillate (when shoots are abbreviated), 3–7 (–12) per annual shoot; petioles 10–35 (–40) mm. long, 0.5–1.5 mm. in diameter; leaf-blades papyraceous or often submembranaceous when dried, dull green or brownish on both sides or somewhat glaucous beneath, oblong- or ovate-elliptic to obovate, (3–) 5–11 (–14) cm. long, (2–) 3–7 (–9) cm. broad, attenuate or obtuse at base, cuspidate at apex with a callose-apiculate acumen usually 2–8 mm. long, denticulate or serrulate at margins (teeth 1–3 per centimeter), glabrous on both sides or frequently brown-hirtellous on nerves and veinlets beneath, the costa slightly raised to slightly impressed above, elevated beneath, the secondary nerves 3–7 per side, arcuate-ascending or subspreading, slightly raised or nearly plane above, faintly elevated beneath, the veinlet-reticulation faint, usually plane on both sides; flowers in the axils of fugacious bracts similar to bud-scales or smaller; ♂ flowers: pedicels slender (0.3–0.8 mm. in diameter), terete, 5–25 mm. long at anthesis, ebracteolate or with a single obscure bracteole near base; perianth-segments 6–8, all essentially similar (outermost 1 or 2 sometimes reduced), submembranaceous, faintly flabellate-nerved, oblong or elliptic-oblong, narrowed at base, rounded at apex, 6–11 mm. long, 2–5.5 mm. broad (outermost rarely only 3.4 × 2 mm.), the innermost 1 or 2 slightly the narrowest; androecium with a stalk 1–2 mm. long, the anthers 1.5–2.5 mm. long; ♀ flowers: pedicels as in the ♂ but 17–38 mm. long at anthesis and up to 1 mm. in diameter; perianth-segments (6–?) 8 or 9, similar to those of ♂ flowers; gynoecium oblong-ellipsoid, the column at anthesis 2–4 mm. long and about 1 mm. in diameter; carpels 17–40, usually 4- or 5-seriate, the ovary ellipsoid or obovoid-ellipsoid, at anthesis 1–1.7 × 0.7–1 mm., essentially open ventrally, the stigmatic crests conspicuous, distally produced into a variable pseudostyle 0.2–0.7 mm. long, proximally extended into 1–3 irregular appendages; fruiting pedicels slender, 15–65 mm. long at maturity, the torus of mature fruits 1.5–8.5 cm. long, often irregularly angled, usually 1–2 mm. in diameter and with 6–23 maturing carpels; carpels subglobose to obovoid, at maturity 6–10 × 5–8 mm., the pericarp faintly glandular; seeds 2 or reduced to 1, ellipsoid-reniform, about 5 × 3.5–4.2 × 2.5–3 mm., the hilar indentation slight, the hilar scar obvious. FIG. 24.

TYPE LOCALITY: Turczaninov based his binomial *Kadsura chinensis* upon a specimen sent him by P. Y. Kirolov from northern China. According to Bretschneider (Hist. Eur. Bot. Disc. China 347. 1898), Kirilov spent many years botanizing in the vicinity of Pei-p'ing. I have seen no material of the species from the immediate vicinity of Pei-p'ing, but specimens from extreme southern Chahar are cited below, and Kirilov apparently extended his trips in this direction, according to Bretschneider.

DISTRIBUTION: Insular east Asia from southern Sakhalin to central Honshu, and on the continent from the Amur River region southward to Korea, Hopeh, and Shansi. See map, *fig. 25.* The species usually occurs at low elevations, especially toward the north, but southward it is recorded up to 1200 m. or even to 1700 m. (in China). The varied habitats recorded by collectors include thickets, forests, woods, moors, open places, etc. In the Amur region *S. chinchsis* is said to occur in deciduous forests characterized by *Betula* and *Populus.*

SAKHALIN (Karafuto): Toyohara, *E. H. Wilson 7346* (A); Odomari and vicinity, *P. H. Dorsett & W. J. Morse 1330* (A, US), *K. Uno 19902* (A, NY); Korsakovsk, *U. Faurie 497* (A), *498* (A); near Kussunai, Exped. Fr. Schmidt (K).

JAPAN: HOKKAIDO: Riishiri Island, *U. Faurie 3004* (UC); Kitami: Rubeshibe, *E. H. Wilson 7390* (A); Ishikari: Vicinity of Sapporo, *U. Faurie 8159* (K), *C. S. Sargent,* Sept. 1892 (A), *Y. Tokubuchi,* June 23, 1891 (K, M), June 1894 (A), Aug. 28, 1894 (UC), *S. Arimoto,* May 7, 1903 (GH), June 1903 (M), Herb. Sapporo Agr. Coll., June 1882 (GH), June 1885 (A, NY); Moiwa, near Sapporo, *H. Takeda 10* (Man), June 21, 1908 (K), *S. Itô,* Sept. 26, 1904 (K); Shiribeshi: Otaru, *U. Faurie 6214* (UC); Iwanai, *U. Faurie 6988* (K); Iburi: Jozankei, Herb. Sapporo Agr. Coll., July 21, 1885 (A); Oshima: Hakodate, *C. Wright,* June 1855 (GH type of *Sphaerostema*

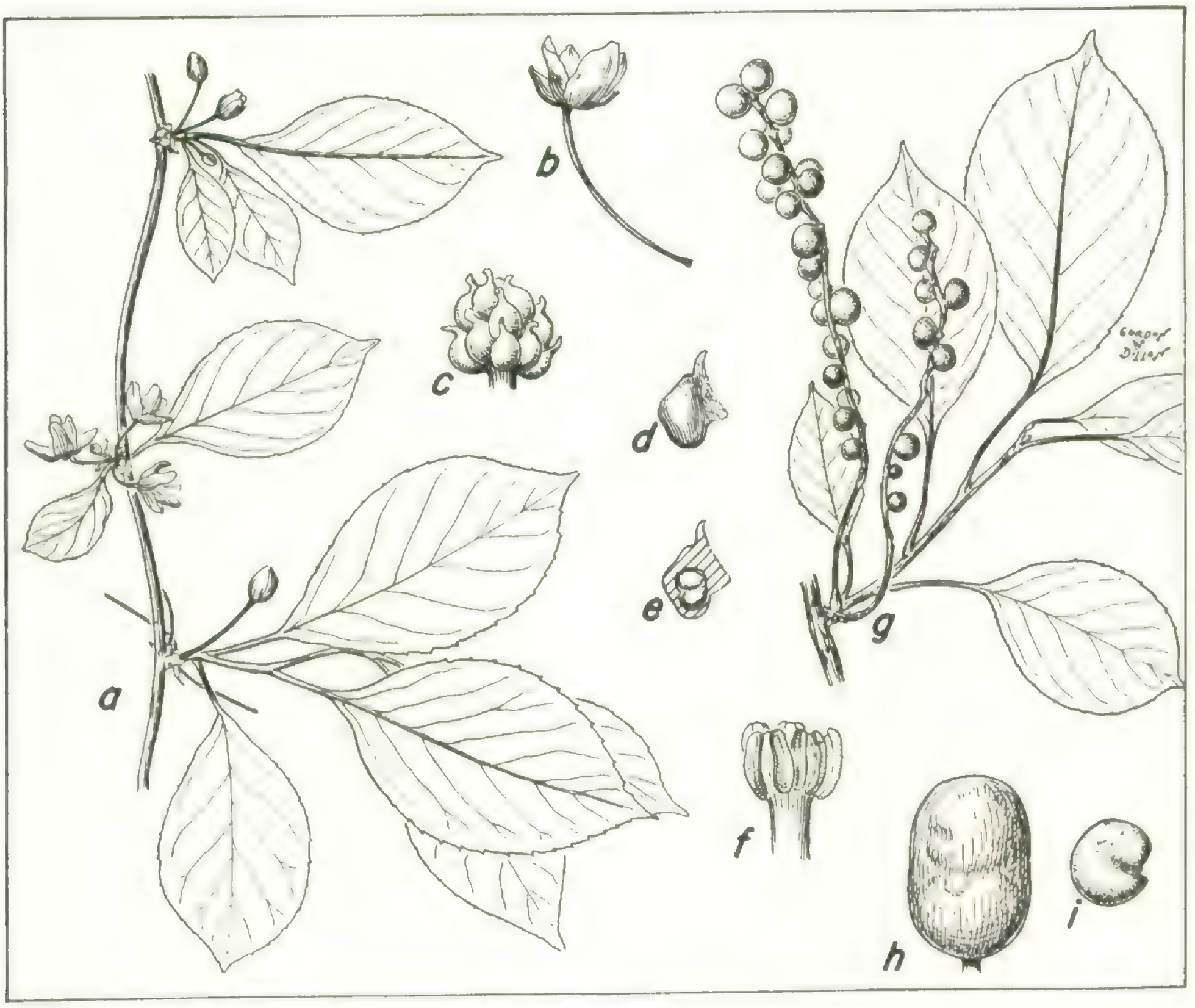

FIG. 24. *Schisandra* § *Maximowiczia*. *a–i. S. chinensis: a.* flowering branchlet, × ½; *b.* ♀ flower, × 1; *c.* gynoecium, × 3; *d.* carpel, × 4; *e.* longitudinal section of carpel, × 4; *f.* androecium, × 4; *g.* fruiting branchlet, × ½; *h.* mature carpel, × 2; *i.* seed, × 2. *Fig. a* drawn from *Mills 68; b–e* from *Palchevsky 652; f* from *Smith 5719; g–i* from *Wilson 7390.*

japonicum, K, NY), *C. Maximowicz* in 1861 (GH, K), *Albrecht* in 1863 (K, M, NY); Province?: Bokke, *T. Tanaka 294* (NY); "southern Hokkaido," *W. P. Brooks 20* (UC), *579* (UC). HONSHU: Akita Pref.: Komagatake (Mt.), *H. Takeda 209* (K); Iwate Pref.: Hayachine (Mt.), *U. Faurie 6913* (A); Nagano Pref.: Near Ouioschidashi-iwa, foot of Mt. Asama, *R. K. Beattie & Y. Kurihara 10104* (A, US); between Kitakaruizawa and Kose, *P. H. Dorsett & W. J. Morse 874* (A, NY, US); Yatsugatake (Mt.), *E. H. Wilson 7535* (A, K); Nagano or Yamanashi Pref.: Misaka Pass (Kai Prov.), *E. H. Wilson 6924* (A, K); Nagano Pref.?: ["Prov. Senano et Nambu"], *Tschonoski* in 1864–66 (GH, K, US).

U. S. S. R.: MARITIME PROVINCE: "Coast of Manchuria," lat. 44–45°, *C. Wilford 1057* (GH, K); Ussuri River, *R. Maack* (GH, K); vicinity of Kharkovka, right bank of Sandut

River, 40 versts w. from Ussurian R. R., *A. P. Shklyaeva, A. P. Radchenko, & I. Koslov,* Aug. 29, 1916 (UC); Sui-fun River, Liusze-chesa Valley, *V. Komarov 652* in part, June 3, 1896 (K); vicinity of Nilolsk-Ussuriysk, left bank of Sui-fun River, *I. Koslov,* June 12, 1915 (UC); vicinity of Vladivostok, *C. S. Sargent,* Aug. 18, 1903 (A), *D. L. Topping 2090* (A), *2107* (A), *2496* (A), *N. Palchevsky* (in Komarov) *652* (A, K). AMUR PROVINCE: Amur River, *R. Maack* in 1855 (GH), *G. Radde* (GH, NY); "am mittleren und südlichen Amur," *C. Maximowicz* (type coll. of *Maximowiczia amurensis,* GH, K, NY); middle Amur River, *S. Korzhinsky,* July 20, 1891 (GH, US); Bakhareva, Bureya River, *S. Korzhinsky,* July 21, 1891 (US); Radde, on Amur River, near Mt. Khingan, *V. P. Popova,* June 21, 1927 (NY); Sutar River, *V. Komarov 652* in part, Aug. 8, 1895 (A).

KOREA: KANHOKU: Mu-san District, Tumen River, *V. Komarov 652* in part, June 1, 1897 (NY); divide between Tumen and Yalu Rivers, *E. H. Wilson 9065* (A). KANNAN: Sempo, *E. H. Wilson 8860* (A, K). HEIHOKU: French Mine, Taiyudo, *E. H. Wilson 8665* (A, K); Pukchin and Takkori, *E. H. Wilson 8701* (A, K). KÔGEN: Yutenji, Kongo-san, *E. H. Wilson 10497* (A, K). KEIKI: Ka-zan, near Suigen, *E. H. Wilson 8479* (A, K). PROVINCE?: Kangkai, *R. G. Mills* in 1910–11 (K, UC); without locality, *K. S. Gilbert 22* (A, UC). For detailed distribution in Korea see Nakai, Fl. Sylv. Koreana **20:** 103. 1933.

CHINA: "Southeastern Manchuria," *C. Maximowicz* in 1860 (K). KIRIN: Near Shih-t'ou-ho-tzu (?), *D. Litvinov 2072* (A); Hsiao-ling, *P. H. & J. H. Dorsett 4098* (A, NY, UC, US), *B. V. Skvortzov* in 1938 (A); Yung-chi (Kirin), *F. H. Chen 402* (A); Tang-ho-ko, Sungari River, to Hui-fa River, *H. E. M. James* in 1886 (K); without legible locality, *J. Ross 309* (K). LIAONING: Lao-yeh Ling and other hills near Shen-yang (Mukden), *H. E. M. James* in 1886 (K); between Shen-yang and Tung-che Hsien, *H. E. M. James* in 1886 (K); between Shen-yang and Ya-lü River, *J. Webster 192* (K); T'ung-hua Hsien, *F. H. Chen 618* (A); Liao-tung Peninsula, near "Sta. Vanfangoo," *D. Litvinov 1767* (NY). JEHOL: Wei-ch'ang, *W. Purdom 117* (A, K); Ch'eng-te (Jehol), *A. David 1839* (GH, K). CHAHAR: Hsiao-wu-t'ai Shan, *F. N. Meyer 1347* (A, Ch, K, M, NY), *C. W. Wang 61754* (A); Shui-shih-tao, Hsiao-wu-t'ai Shan, *J. Hers 2154* (A); T'ieh-lin-ssu, Hsiao-wu-t'ai Shan, *J. C. Liu 1919* (UC), *H. W. Kung 79* (NY). HOPEH: Yang-ts'un, n. w. of T'ien-ching, *E. Licent 1885* (K); T'ien-ching, *E. Licent 8409* (K); without definite locality, *C. F. Li 11173* (NY), *H. T. Tsai 50458* (US). SHANSI: Ch'o-mei Shan, Chieh-hsiu Hsien, *H. Smith 5719* (A); Mien Shan, Ling-shih Hsien, *T. Tang 972* (A); between Tsi-li-yü and Ho Shan, *E. Licent 12067* (A); "Si han," central Shansi, *E. Licent 2345* (K).

CULTIVATED: Hort. Arnold Arb., June 1, 1883 (A); *A. Rehder,* May 25, 1899 (A) (Arnold Arb.); Biltmore Herb. 10778 (US) (Biltmore, N. C.); "Hort. Parkman" (GH); *G. Nicholson 592* (A) (cult. Kew); *A. Rehder 3030* (A) (cult. Jena Bot. Gard.); *H. Zabel,* 1875–1895 (A) (cult. Bot. Gard. Forstakad., Muenden, Hannover); "Herb. Bot. Hort. Maximowicz" (K); *E. Baroni,* May 1898 (K) (cult. Hort. Bot. Florence).

LOCAL NAMES, USES, and COLOR NOTES: The most commonly recorded Chinese name for this species is *Wu-wei-tzu* or a variant, meaning "five tastes plant." The fruit is edible and is used medicinally. According to Hooper (in 1929, cited above), tonic, aphrodisiac, pectoral, and lenitive properties are ascribed to the drug; the fruit also contains a viscid material with which Japanese women dress their hair. Other local names are: *Ng mee tse; Pen ts'ao* (Hooper); *Bac ngu vi tu* (Chinese name according to Crevost & Pételot in 1929); *Ô-mi-dja* (in Korea, according to Nakai); *Chôsen-gomishi* or a variant (in Japan, according to various authors; this seems to imply a Korean origin for the plant, and Tanaka [in 1895] remarks: "Brought from Corea about 1717," but I have found no other evidence indicating that the species is not native to Japan); *Matsbouza; Oushi boadô* (in Japan, according to Franchet & Savatier in 1873); *Kotziafa; Kotzialta* (in Amur region, according to Maximowicz); *Lemon-wood* (translation of a Russian name used in Maritime Province, according to Kozlov). Darnell, in 1930, gives the name *Chinese Mock-barberry* for the species in cultivation.

The flowers are found at anthesis from May to July and have white to yellowish perianth-segments; the fruits, which apparently vary from pink to red, mature between July and October.

SYNONYMY: In proposing the binomial *S. chinensis,* Baillon is far from clear as to the basonym. He apparently would have preferred to base his combination upon *Sphaerostema japonicum* A. Gray, but was deterred by the earlier *Kadsura japonica* (L.) Dun.; in combining *Kadsura* with *Schisandra* Baillon made the combination *Schizandra japonica* for the Linnaean concept. It is not clear, therefore, whether Baillon's *S. chinensis* is proposed as a new name for Gray's *Sphaerostema japonicum* or whether it is a new combination based on

"Maximovitzia" chinensis Rupr., which Baillon also cites. Apparently he did not observe that Ruprecht's binomial was based on the older *Kadsura chinensis* Turcz. Although I am uncertain whether in this case one is justified in inserting the correct parenthetical author and in considering Baillon's name to be a new combination, I follow tradition by using the authorship "(Turcz.) Baill."

Sphaerostemma japonica (sic) Sieb. & Zucc. is a *nomen nudum* and its existence does not affect the status of *Sphaerostema japonicum* A Gray. The latter is based upon the Wright specimen from Hokkaido cited by me above and is clearly synonymous with Turczaninov's concept.

Maximowiczia amurensis Rupr. (1856), published in connection with the monotypic genus *Maximowiczia* Rupr., was almost immediately recognized as being a synonym of *Kadsura chinensis*, and the combination retaining the genus *Maximowiczia* was proposed in 1859. The

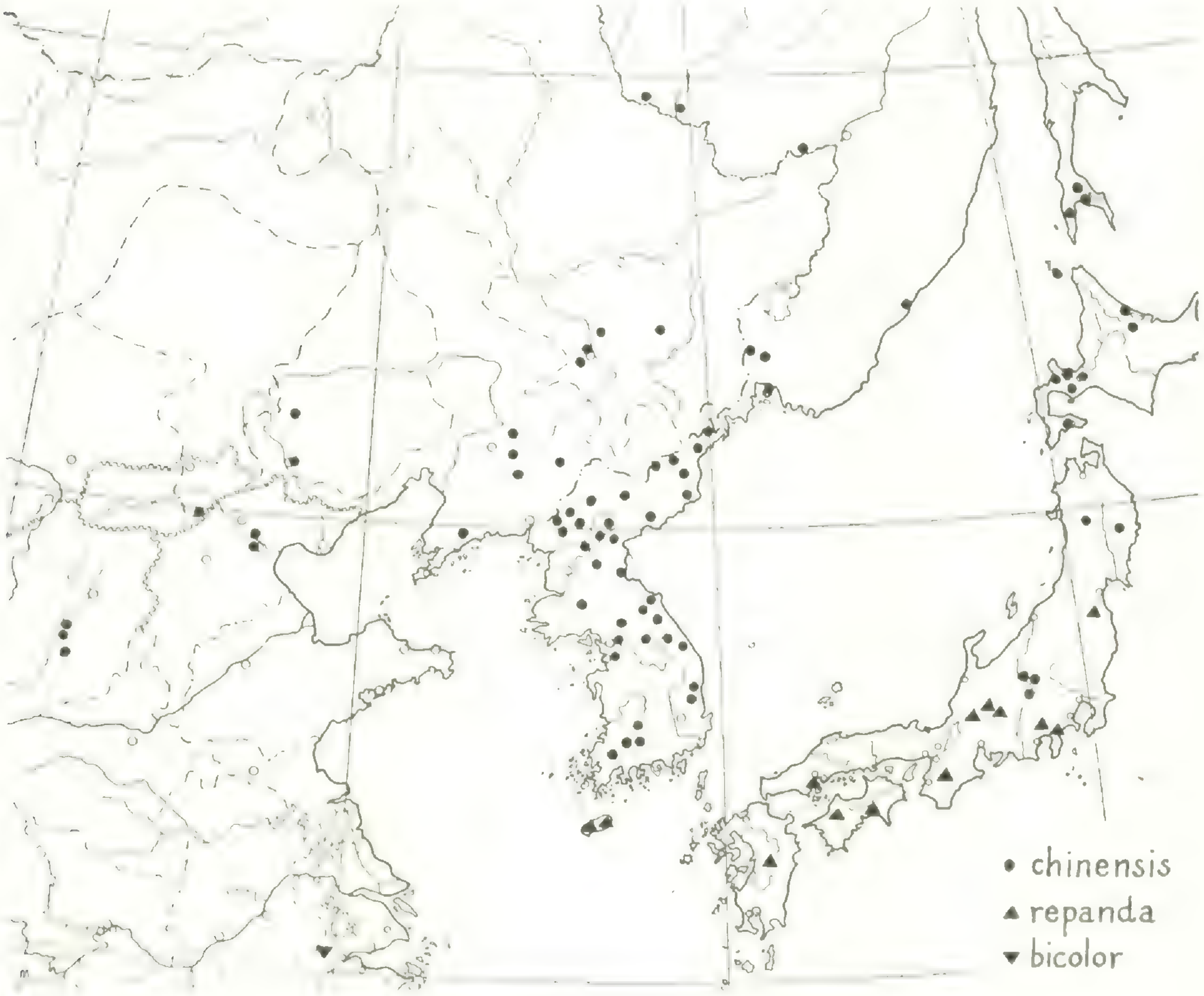

FIG. 25. Approximate known distribution of *Schisandra chinensis*, *S. repanda*, and *S. bicolor*.

type of Ruprecht's genus and species is a Maximowicz specimen from the Amur River region, of which duplicates are cited by me above. Ruprecht's generic name has suffered several orthographic variations, which I have listed above.

Numerous unnecessary combinations, proposed in synonymies, have been inflicted upon the present species; for the sake of bringing this record together I have listed the many variations above.

Nakai (29) proposed to divide *S. chinensis* into two varieties, based upon the presence (var. *typica*) or absence (var. *glabrata*) of pubescence on the nerves of the lower leaf-surfaces. Such variation in this character exists, without respect to geographical ranges, that I hardly consider it of nomenclatural value. The type of Nakai's var. *glabrata* is *T. Ishidoya* (Herb. Imp. Univ. Tokyo), from Korea.

Schisandra chinensis clearly represents a separate section of the genus, which may be instantly recognized if the androecium is present. Lacking ♂ flowers,

one might confuse the plant with *S. sphenanthera* (§ *Pleiostema*), as discussed above under that species, or with *S. repanda* (§ *Euschisandra*). From the latter the obvious seed characters distinguish *S. chinensis*, and the foliage may also be used, if ample material is available, to separate *S. repanda* and *S. chinensis*.

20. **Schisandra** (§ *Euschisandra*) **glabra** (Brickell) Rehder in Jour. Arnold Arb. **25:** 131. 1944.

Stellandria glabra Brickell in Med. Repos. New York **6** (no. 3): 327. 1803 (end Feb. or early March).

Schisandra coccinea Michx. Fl. Bor.-Am. **2:** 219. *tab. 47.* 1803 (March); Willd. Sp. Pl. **4:** 372. 1805; Poir. Encyc. Méth. Bot. **6:** 729. 1805; Pers. Syn. Pl. **2:** 558. 1807; Sims in Curtis's Bot. Mag. **34:** *pl. 1413.* 1811; Aiton f. Hort. Kew. ed. 2. **5:** 268. 1813; Pursh, Fl. Am. Septr. **1:** 212. 1814; Nutt. Gen. N. Am. Pl. **2:** 209. 1818; Barton, Fl. N. Am. **1:** 45. *tab. 13.* 1821; Link, Enum. Pl. **2:** 391. 1822; Schneid. Ill. Handb. Laubholzk. **1:** 341. 1905; Rehder, Man. Cult. Trees and Shrubs 260. 1927, ed. 2. 255. 1940.

Schizandra coccinea Michx. ex Desf. Hist. Arb. Arbiss. **2:** 25. 1809; DC. Reg. Veg. Syst. Nat. **1:** 544. 1817, Prodr. **1:** 104. 1824; Spreng. Syst. Veg. **1:** 972. 1825; Guillem. in Dict. Class. Hist. Nat. **15:** 239. 1829; G. Don, Gen. Syst. **1:** 101. *f. 26.* 1831; Loudon, Arb. et Frut. Brit. **1:** 295. *f. 41.* 1838; Torr. & Gray, Fl. N. Am. **1:** 46. 1838; Spach, Hist. Nat. Veg. **8:** 11. 1839; Dietr. Syn. Pl. **2:** 1037. 1840; A. Juss. in Orbigny, Dict. Univ. Hist. Nat. **11:** 416. 1848; A. Gray, Gen. Pl. U. S. **1:** 58. *pl. 22* (err. *pl. 27*). 1849; Darby, Bot. Southern States **2:** 213. 1855; Chapman, Fl. Southern U. S. 13. 1860; Baill. Hist. Pl. **1:** 148. *f. 179–181.* 1868–69; Hemsl. in Garden **8:** 271. 1875; Le Maout & Dec. Traité Gén. Bot. 378. *f.* 1878; Eichl. Blüthendiagr. **2:** 151. 1878; Nichols. Ill. Dict. Gard. **3:** 383. *f. 445.* 1887; Prantl in E. & P. Nat. Pfl. III. **2:** 18. *f. 16.* 1888; A. Gray, Syn. Fl. N. Am. **1:** 58. 1895; Rehder in Bailey, Cycl. Am. Hort. **4:** 1625. 1902; Small, Fl. Southeastern U. S. 451. 1903; Rehder in Bailey, Stand. Cycl. Hort. **6:** 3110. 1917.

Monoecious or apparently often dioecious high-climbing or scrambling vine, the main stem not more than 1 cm. in diameter near base, glabrous throughout; young branchlets brown, striate, 1–2 mm. in diameter, the older ones often cinerascent, subterete, often rugulose, 2–4 mm. in diameter; bud-scales papyraceous, oblong, the largest ones up to 6 mm. long, fugacious; leaves 3–12 on the short or elongate annual shoots; petioles slender (0.5–1 mm. in diameter), (10–) 15–60 mm. long; leaf-blades somewhat succulent when fresh, drying papyraceous or submembranaceous, dull green to brown on both sides or sometimes nearly glaucous beneath, oblong-elliptic to ovate or lanceolate, (4–) 6–13 (–16) cm. long, (2–) 3–9 (–13.5) cm. broad, attenuate to obtuse at base (subcordate on largest leaves), cuspidate or short acuminate at apex (acumen 5–10 mm. long, callose-apiculate), entire or faintly sinuate or remotely undulate-denticulate at margin, the costa faintly impressed above, elevated beneath, the secondary nerves (3–) 4 or 5 per side, arcuate- or straight-ascending, plane or slightly raised above, prominulous or elevated beneath, the veinlet-reticulation inconspicuous, plane on both sides or faintly prominulous beneath; flowers sometimes subtended by 2 or 3 minute secondary bracts; ♂ flowers: pedicels very slender (0.3–0.7 mm. in diameter), 15–35 mm. long at anthesis, ebracteolate; perianth-segments 9–12, the outer ones papyraceous or submembranaceous and often pellucid-punctate, the inner ones thin-carnose, the outermost 1 or 2 oblong-suborbicular, often ciliolate, 1.2–4 × 1.5–4 mm., the largest ones elliptic to obovate, usually eciliate, 5–8 × 3.5–6 mm., the innermost 4–6 somewhat reduced, 4–7 × 2.5–5 mm., narrowed and thickened at base; androecium minutely glandular, 3–4.5 mm. in diameter and about 0.5 mm. thick (high) at anthesis, the anthers 1–2.3 mm. long and 1.3–2.5 mm. broad at apex at anthesis, the thecae 0.5–0.7 mm. long; ♀ flowers: pedicels as the ♂ but 20–50 (–70) mm. long at anthesis; perianth-segments similar to those of ♂ flowers; gynoecium oblong-ellipsoid, the column cylindric-ellipsoid, at anthesis 1.5–3 mm. long and 1–1.5 mm. in diameter; carpels (12–) 20–30,

usually 3–5-seriate, the ovary subfalcate-ellipsoid or obovoid, at anthesis 1.5–2.3 × 0.7–1 mm., the stigmatic crests narrow, produced distally into a subulate or conical acute pseudostyle 0.2–0.5 mm. long, extended proximally into an irregularly oblong appendage often 0.3–1 × 0.1–0.3 mm., the ovules 2 (rarely 3); fruiting pedicel not much enlarged or lengthened, the torus of mature fruits 2–3.5 cm. long, subterete, 1.3–2 mm. in diameter, usually with 7–12 maturing carpels; carpels ellipsoid to subglobose, at maturity 5–10 mm. in diameter, the pericarp usually copiously yellow-glandular; seeds 2 (rarely 1, possibly sometimes 3), ellipsoid-reniform, about 5.5 × 4–4.5 mm., the hilar indentation slight, the testa minutely or quite obviously rugulose.

TYPE LOCALITY: In the original publication of his new genus and species, Brickell states: "I send a description of the *Stellandria*, . . . which grows in the woods near this town . . ." [Savannah, Georgia]. The abundant material collected by Mellichamp in the next county to the north (Beaufort Co., S. Carolina) is essentially topotypical. Michaux, in his original publication of *Schisandra coccinea*, states merely: "Hab. in umbrosis Carolinae et Georgiae."

DISTRIBUTION: Southeastern U. S., coastal plain and Mississippi embayment, from southern South Carolina, Georgia, and northern Florida westward to Tennessee, Arkansas, and Louisiana. See map, *fig. 26*. Gray (Syn. Fl. N. Am. **1**: 58. 1895) and a few others who have perhaps repeated his statement mention the range as extending to eastern Texas, but I have seen no herbarium material supporting this. The species is apparently very scattered and rare in its occurrence, and the available herbarium specimens are distressingly inadequate as to data. My distribution map of this species, therefore, is far from satisfactory. Palmer notes that in Arkansas the species is a high climber and occurs in ravines and on steep slopes in loess hills.

U. S.: SOUTH CAROLINA: Beaufort Co.: Vicinity of Bluffton or Beaufort, *J. H. Mellichamp*, 1881–1897, numerous collections (A, Ch, GH, M, NY, UC, US). GEORGIA: County?: Steagalls Stations, *W. S. Grant* in 1874 (US). FLORIDA: Liberty Co.: Aspalaga, *A. W. Chapman*, May 1898 or without date (M, NY); County?: *M. A. Curtis* (GH), *A. W. Chapman* (GH, NY), Herb. Chapman 196 (M); *H. B. Croom* (NY). ALABAMA: Marengo Co.: Luthers Store, *C. Mohr*, May 1893 (M, US); without detailed locality, *C. Mohr*, May 1893 (M); Clarke Co.: West slope of Salt Mountain, *R. M. Harper 3377* (A, GH, M, NY). TENNESSEE: Tipton Co.: Near Covington, *J. Byars*, June 27, 1888 (US), July 10, 1888 (US), May 1, 1889 (NY, US). ARKANSAS: Phillips Co.: Crowley's Ridge, near Helena, *E. J. Palmer 25094* (A, M), *26621* (A, M); Helena (cult.), *Mrs. White*, May 23, 1907 (M). MISSISSIPPI: Without data, *R. H. Browne* in 1850 (NY). LOUISIANA: East or West Feliciana Co.: "Feliciana," *"W. M. C."* [*W. M. Canby?*] (NY); County?: *C. W. Short* (Ch, GH, NY), *J. Hale* (Ch, GH, NY), *Collector?* (GH); "New Orleans," *Ingalls* (NY).

LOCAL NAME and COLOR NOTES: Apparently only Small (in 1903) has recorded a local name for this species: *Bay-star vine*. The flowers are mature in May or June; the outer perianth-segments are greenish, the inner ones increasingly bright red or crimson, and the androecium is also red. The thecae are apparently yellow, as Brickell poetically remarks: "antherae like golden stars set in a crimson field." The fruits are red or scarlet and seem to mature in July and August.

SYNONYMY: The two earliest descriptions of this species, those of Brickell and Michaux, are both very explicit, and there can be no doubt that the same species—so completely unlike any other American plant—was under consideration. In both cases a new genus was based upon the species, Brickell and Michaux being well aware of what a remarkably distinct entity was at hand.

The identity of Brickell's genus and species with those of Michaux was recognized by the compilers of the Index Kewensis, but until Rehder's discussion in 1944 the Brickell entity was essentially ignored. While it may be a matter of regret that Michaux's well known specific epithet is to be replaced by Brickell's overlooked one, I am in agreement with Rehder that this solution is called for. The conservation of the genus *Schisandra* over *Stellandria*, as proposed by Rehder, is of course highly desirable.

The only American representative of the Schisandraceae is closely allied to the Asiatic *S. repanda*, discussed below, but obvious differences in foliage, number of carpels, and texture of seed, as utilized in my key to species, permit the ready separation of the two species.

21. **Schisandra** (§ *Euschisandra*) **repanda** (Sieb. & Zucc.) comb. nov.

Trochostigma repanda Sieb. & Zucc. in Abh. Bayer. Akad. Wiss. Math. Phys. **3:** 728. 1843.

Schizandra nigra Maxim. in Bull. Acad. Sci. St. Pétersb. **17:** 144. 1872; Franch. & Sav. Enum. Pl. Jap. **1:** 18. 1873; Tanaka, Useful Pl. Jap. 109. 1895; Rehder in Bailey, Cycl. Am. Hort. **4:** 1625. 1902; Beissn., Schelle, & Zabel, Handb. Laubh.-Benen. 102. 1903; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 50. 1905 [repr. Contr. Fl. As. Or. **2:** 50. 1907]; Matsum. Ind. Pl. Jap. **2** (2): 97. 1912; Mori, Enum. Pl. Corea 166. 1922; ? Crevost & Pételot in Bull. Econ. Indochine **32:** 22. 1929; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 358. 1931; Otani in Jour. Jap. Bot. **8:** (139). *pl.* 1932; Nakai, Fl. Sylv. Koreana **20:** 101. *tab. 19.* 1933; Bean, Trees and Shrubs Brit. Isles **3:** 454. 1933; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 241. 1936; Sugimoto, Key Trees and Shrubs Japan 87. 1936.

FIG. 26. Approximate known distribution (by counties) of *Schisandra glabra*. Each symbol represents a county from which herbarium material is available.

Schisandra nigra Maxim. ex Schneid. Ill. Handb. Laubholzk. **1:** 341. *f. 218, b.* 1905; Rehder, Man. Cult. Trees and Shrubs 260. 1927, ed. 2. 254. 1940.

Schizandra discolor Nakai, Fl. Sylv. Koreana **20:** 103. 1933; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 241. 1936; Sugimoto, Key Trees and Shrubs Japan 87. 1936.

Dioecious (or sometimes monoecious?) vine, glabrous throughout, the main stem up to 1 cm. in diameter toward base, the branches characteristically bearing stout lateral spur-like short shoots with leaves and flowers distally, these sometimes developing into long shoots; young branchlets brown, slightly angled, 1.5–2.5 mm. in diameter, the older ones often cinereous, subterete, sometimes rugulose, 3–5 mm. in diameter, the older parts of short shoots with conspicuous

leaf-scars; bud-scales papyraceous, ovate-oblong, the largest ones 3–7 mm. long, fugacious; leaves alternate on long shoots or subverticillate in clusters of 3–6 on short shoots; petioles (7–) 20–60 mm. long, 0.7–1.5 mm. in diameter; leaf-blades drying papyraceous or submembranaceous, dull green or brownish on both sides, sometimes glaucous beneath, broadly ovate or suborbicular, (3–) 4–8 (–9.5) cm. long, (2–) 3–6 (–8) cm. broad, obtuse to rounded at base, cuspidate at apex (acumen 3–10 mm. long, obtuse or acute, callose-apiculate), remotely denticulate or undulate-dentate at margin (teeth about 1 per centimeter), the costa slightly raised on both sides, the secondary nerves 3 or 4 per side, subspreading, slightly raised or prominulous on both sides, the veinlet-reticulation copiously but obscurely anastomosing, plane or slightly prominulous on both sides; flowers toward base of annual growth on short shoots; ♂ flowers: pedicels 15–40 mm. long and 0.5–1 mm. in diameter at anthesis, ebracteolate; perianth-segments 7–10, membranaceous (or innermost few subcarnose), usually copiously yellow-glandular, eciliate but sometimes faintly erosulous at margin, the outermost 1 or 2 oblong-elliptic or suborbicular, 2–5 mm. long and broad, the largest ones elliptic-obovate, 5–8 × 4–6 mm., the innermost 2 or 3 obovate, slightly narrowed; androecium as in *S. glabra,* 2.7–4.2 mm. in diameter and 0.5–1 mm. thick at anthesis, copiously immersed-glandular, the connective 1–2 mm. broad at apex, the thecae 0.7–1 mm. long; ♀ flowers: pedicels as the ♂ but 24–70 mm. long at anthesis; perianth-segments similar to those of ♂ flowers; gynoecium ellipsoid, the column oblong-conical, at anthesis 2–2.5 mm. long and 1–1.2 mm. in diameter; carpels usually 12–16, about 4-seriate, the ovary obovoid-ellipsoid, at anthesis 2–2.5 × 0.6–1 mm., the stigmatic crests inconspicuous, produced into a subulate pseudostyle 0.3–0.6 mm. long, extended proximally into an irregular appendage 0.6 mm. long or smaller, the carpel-wall copiously immersed-glandular; fruiting pedicel not much elongated, 35–80 mm. long at maturity, the torus of mature fruits normally 2.5–6.5 cm. long but sometimes much shortened, 1.5–3 mm. in diameter, usually with 8–15 maturing carpels; carpels ellipsoid or subglobose, at maturity 10–15 × 8–12 mm., the pericarp immersed-glandular; seeds 2 (rarely 1), ellipsoid-subreniform, 5.5–6 × 4.5–5 mm., the hilar indentation slight, the testa conspicuously and copiously rugulose-tuberculate. FIG. 27.

TYPE LOCALITY: "Crescit in Japonia meridionali" [Sieb. & Zucc.]; the type collection is presumably the Bürger plant cited and discussed below.

DISTRIBUTION: Japan (central and southern Honshu, Shikoku, and Kyushu) and Quelpaert Island, southern Korea, in woods and thickets at elevations up to 1100 m. See map, *fig. 25.*

JAPAN: Without definite locality, *Bürger* (TYPE COLL., K). HONSHU: Fukushima Pref.: Fukushima, *J. H. Veitch,* Sept. 13, 1892 (A), *C. S. Sargent,* Oct. 28, 1892 (A); Kanagawa Pref.: Hakone, *Collector?,* Aug. 18, 1883 (K); Shizuoka Pref.: Fujiyama (Mt.), *C. Maximowicz* in 1862 (cotype coll. of *S. nigra,* NY, US); Shizuoka Pref.?: "Nikko & Fujiyama" [probably the latter], *Marics* (K); Nagano Pref.: Nojiri, *J. G. Jack,* Sept. 6, 1905 (A); Otaki-gawa (River), *E. H. Wilson 7744* (A); Tsubakura-dake, *E. H. Wilson 7473* (A); Nagano Pref.?: ["Prov. Senano"], *Tschonoski* in 1864 (cotype coll. of *S. nigra,* GH, K, NY, US); Gifu Pref.: [Mino Prov.], *K. Shiota 4423* (A), *6494* (A); Nara Pref.: Yoshino, *Collector? 23* (US); Pref.?: Base of Jizogatake (Mt.), *U. Faurie 5391* (A, UC). SHIKOKU: Ehime Pref.: Ukena, *Collector?,* Sept. 29, 1891 (K); Kochi Pref.: Nanokawa, Tosa, *K. Watanabe,* July 12, 1889 (GH, US). KYUSHU: "In sylvis alpinis jugi Kundsho-san," *C. Maximowicz* in 1863 (cotype coll. of *S. nigra,* GH, K).

KOREA: QUELPAERT I.: Hallai-san, *T. Taquet 940* (A, K), *E. H. Wilson 9446* (A, K); without detailed locality, *U. Faurie 1678* (A).

LOCAL NAMES, USES, and COLOR NOTES: *Matsubusa* is the Japanese name most often reported for this species, but *Ushibudo* is also used, and Nakai mentions *Urajiro-matsubusa* for *S. discolor,* which I consider a synonym. In Korea, according to Nakai, the species is known as *Ohmidja.* The fruits are said to be edible, and according to Tanaka they are used medicinally.

Although color notes are inconclusive, the dried flowers suggest that the perianth-segments (and probably the androecium) are white to yellowish when fresh. Maximowicz states: "Flores . . . lactei." Thus a color difference between this species and the American *S. glabra* is probable. Flowers at anthesis have been collected from May to July. The fruits mature from August to November and, according to Wilson, are "bloomy black."

SYNONYMY: Maximowicz based his *S. nigra* upon four specimens, three of which (collected by Maximowicz and Tschonoski) are cited above as cotype collections. The fourth, a specimen from Yezo (Hokkaido) obtained by Albrecht, can scarcely represent the present species, which does not occur on Hokkaido. The Albrecht specimen doubtless represents *S. chinensis,* as which it has been cited in the present treatment.

Nakai's *S. discolor* is typified by a specimen collected by Hayata on Miyajima Island, Hiroshima Prefecture, Honshu. This locality falls within the known range of *S. repanda.*

The genus *Trochostigma* Sieb. & Zucc. was proposed in 1843 (in Abh. Bayer. Akad. Wiss. Math. Phys. **3**: *726–729*), with five species. The genus has been referred to the synonymy of *Actinidia,* and it has often been assumed that two or three of Siebold & Zuccarini's binomials were referable to *Actinidia polygama* (Sieb. & Zucc.) Planch. ex Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Etrang. **9**: 64. 1859 (apparently the earliest publication of this binomial). In a later publication (Bull. Acad. Sci. St. Pétersb. **31**: 19. 1887) Maximowicz definitely refers to *Actinidia polygama* the three binomials *Trochostigma polygama, T. volubilis,* and *T. repanda,* all proposed by Siebold & Zuccarini in their original publication. This disposition of *Trochostigma repanda* has subsequently been followed (e. g. Index Kewensis; Hook. f. in Curtis's Bot. Mag. **122**: *t. 7497.* 1896, etc.), and apparently the original description and the type collection have not been carefully examined.

The complete original description of *Trochostigma repanda* follows:

"Tr. foliis e basi rotundata ovatis acutis basi et in acumine obtuso integerrimis, ceterum remote repando-crenatis crenis rotundatis glandula mucronatis, utrinque glabris, petiolis laminam subaequantibus, pedunculis axillaribus filiformibus unifloris aeque ac calyces glabris. *Crescit in Japonia meridionali.*"

This description obviously does not apply to *Actinidia polygama,* but I should not have suspected a species of *Schisandra* to be concerned if the material loaned me from Kew had not included a specimen which is certainly a type collection of *Trochostigma repanda.* This specimen is a duplicate from the Munich Herbarium, where Zuccarini's actual types are presumably deposited. The label (in Zuccarini's handwriting?) reads: "Trochostigma repanda Sieb. & Zucc. In Japonia legt. Bürger, comovl. [?] von Siebold. Ex herbario Lugduno-Batavo."

In view of the excellent agreement between this specimen and the original description, I think that it is doubtless to be taken as a type duplicate of *Trochostigma repanda.* Fortunately some individual at Kew suspected it of being a *Schisandra* and changed its position in the herbarium. There cannot be the slightest doubt that this specimen represents the same entity as *Schisandra nigra* Maxim. It bears one attached flower (undissected) and is accompanied by parts of a dissected ♂ flower in a pocket. The evidence of these flowers and all the habit and foliage characters point unmistakably to *S. nigra;* furthermore, if the original description is perused with this species in mind, the agreement is striking. Siebold & Zuccarini's species has priority of some 29 years over Maximowicz's, and therefore the binomial which I propose above seems inevitable.

Nakai's species from Honshu, *S. discolor,* is based on fruiting material and is differentiated from *S. nigra* by "grayish bark and the leaves niveo-glaucous on the undersurface." These characters seem inadequate, and the entity is probably to be included in a reasonable concept of *S. repanda.* It seems certain that *S. dis-*

color cannot be referred to *S. chinensis,* which does not occur in southern Honshu. Unfortunately Nakai does not describe the surface of the seed, a dependable character in separating § *Euschisandra* from § *Maximowiczia.*

In his statement that both of the Korean species of *Schisandra* fall into § *Maximowiczia,* Nakai (29: 101) is in error; his Korean specimens of *S. repanda* lacked flowers and consequently he ignored the striking androecial differences between the two sections concerned.

Although *S. repanda* may possibly be confused with *S. chinensis,* the differences in flowers and seeds prohibit confusion if these are present. The leaf-blades of

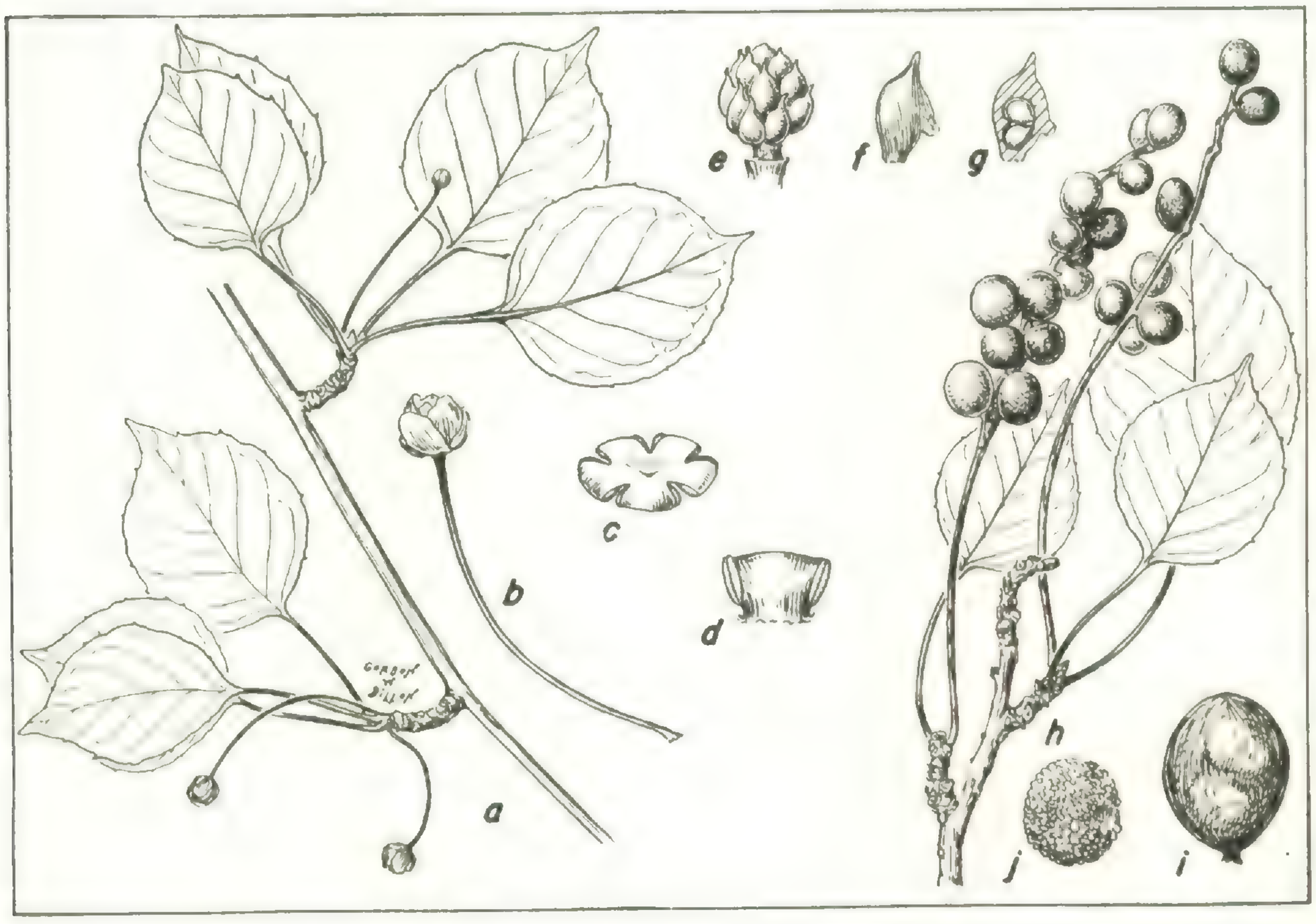

FIG. 27. *Schisandra* § *Euschisandra. a–j. S. repanda: a.* ♂ flowering branchlet, × ½; *b.* ♂ flower, × 1; *c.* androecium, × 3; *d.* dorsal (lower) view of an anther, × 5; *e.* gynoecium, × 3; *f.* carpel, × 4; *g.* longitudinal section of carpel, × 4; *h.* fruiting branchlet, × ½; *i.* mature carpel, × 1; *j.* seed, × 2. *Figs. a–d* drawn from *Watanabe,* July 12, 1889; *e–g* from *Tschonoski* in 1864; *h–j* from *Wilson 9446.*

S. repanda are proportionately broader than those of *S. chinensis,* and even in sterile condition the two plants should be readily separable. Furthermore, the area of geographical overlap (on Honshu) is very limited; in Korea the ranges appear to be distinct. *Schisandra repanda* is definitely more southern in its distribution than *S. chinensis.*

22. **Schisandra** (§ *Euschisandra*) **bicolor** Cheng in Contr. Biol. Lab. Sci. Soc. China **8:** 137. *f.* 5. 1932, **9:** 283. 1934.

Plant monoecious, glabrous, with short shoots suggestive of those of *S. repanda;* young branchlets reddish, lightly angled, the older ones brownish purpurascent or cinereous; bud-scales small, ovate, acute, presumably fugacious; leaves congested in clusters of 3 or 4 on short shoots, the petioles 20–45 mm. long; leaf-blades succulent when fresh, thin when dried, greenish above, paler

beneath, orbicular or elliptic to obovate, 5.5–9 cm. long, 3.5–8 cm. broad, broadly cuneate at base, cuspidate at apex, callose-denticulate or rarely entire at margin, the secondary nerves 4–6 per side, subspreading, plane above, slightly elevated beneath; ♂ flowers: pedicels slender, 10–15 mm. long at anthesis, ebracteolate; perianth-segments 7–13, the outermost ones orbicular or elliptic-oblong or rarely obovate, 3.6–6 × 3–4 mm., the largest ones oblong to oblong-obovate or rarely orbicular, 5–7 × 2.8–6 mm.; androecium as in *S. glabra,* 4 mm. in diameter, the connective about 2 mm. broad and truncate or rounded at apex; ♀ flowers: pedicels 20–60 mm. long at anthesis; perianth-segments similar to those of ♂ flowers; gynoecium broadly ovoid, with about 16 carpels, these obliquely elliptic or oblong, about 2 mm. long; fruit unknown.

TYPE LOCALITY: Western T'ien-mu Shan, near "Sienting" [doubtless Hsin-teng Hsien], northwestern Chekiang, China; *W. C. Cheng 3656,* collected July 1, 1932, is the type.

DISTRIBUTION: Known only from the type locality (two collections), at an altitude of 1400 m. See map, *fig. 25.*

COLOR NOTES: The outer perianth-segments are said to be greenish, the inner ones and the androecium scarlet.

Although I have seen no material referable to *S. bicolor,* Cheng's original description and figure leaves no doubt that a species of § *Euschisandra* of the relationship of *S. repanda* is concerned. The only other *Schisandrae* known from Chekiang are *S. Henryi,* var. *marginalis* and *S. viridis,* both of § *Pleiostema.* These entities will at once be distinguishable from *S. bicolor* by the characters of their ♂ flowers, but in fruit they may be difficult to differentiate from Cheng's species. The fruits of *S. bicolor,* as yet unknown, will probably prove to have rugulose seeds like those of other species of § *Euschisandra.* Both entities of § *Pleiostema* mentioned above also have rugulose seeds. In foliage all three Chekiang elements may have more or less bicolored leaves, but those of *S. bicolor* are presumably proportionately broader and more or less orbicular-elliptic. In general, neither entity of § *Pleiostema* has such contracted short shoots as appear to characterize *S. bicolor* and its relative *S. repanda.* Furthermore, the subpersistent bud-scales and angled young branchlets of *S. Henryi* var. *marginalis* distinguish it. I have referred to *S. viridis* two Chekiang collections (*Hu 1693, Keng 601*) in fruit which may conceivably represent *S. bicolor,* although their leaf-shape does not imply it.

Cheng states that *S. sphenanthera* (i. e. *S. viridis*) is common in Chekiang at lower elevations than *S. bicolor,* which appears to be rare and restricted to higher levels. It is hoped that further collections from the region will permit a better understanding of this Chinese representative of § *Euschisandra.*

My description above is taken from Cheng's. Without seeing specimens of § *Euschisandra* from Chekiang it is difficult for me to evaluate the differences between this entity and *S. repanda,* but that differences of specific quality exist seems certain. Possibly the flower-color will prove a dependable character.

23. **Schisandra** (§ *Sphaerostema*) **axillaris** (Bl.) Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 45, quoad basonym, as *Schizandra a.* 1872.

Sphaerostema axillare Bl. Bijdr. Fl. Ned. Ind. 22, as *S. axillaris.* 1825; Spreng. Syst. Veg. **4** (2): 261. 1827; Bl. Fl. Jav. [Schizandr.] 14. *tab. 3.* 1830; Hassk. Cat. Pl. Hort. Bot. Bog. 177. 1844.

Sphaerostema pyrifolium Bl. Fl. Jav. [Schizandr.] 16. *tab. 4.* 1830.

Uvaria pyrifolia Reinw. ex Bl. Fl. Jav. [Schizandr.] 16, as synonym. 1830.

Sphaerostemma axillare Bl. ex G. Don, Gen. Syst. **1**: 101, as *S. axillaris.* 1831; Walp. Rep. Bot. Syst. **1**: 92. 1842; Miq. Fl. Ned. Ind. **1** (2): 19. 1858.

Sphaerostemma pyrifolium Bl. ex Walp. Rep. Bot. Syst. 1: 92. 1842; Miq. Fl. Ned. Ind. 1 (2): 19. 1858; Baill. in Adansonia 3: 43. 1862.

Schizandra axillaris Hook. f. & Thoms. ex Backer, Schoolfl. voor Java 16. 1911; Koorders, Exkursionsfl. Java 2: 243. *f. 52.* 1912.

Schizandra pyrifolia Backer, Schoolfl. voor Java 16. 1911.

Sphaerostemma pirifolium Bl. ex Koorders, Exkursionsfl. Java 2: 243, as synonym. 1912.

Sphaerostemma pirifolium var. *denticulatum* Bl. ex Koorders, Exkursionsfl. Java 2: 243, as synonym. 1912.

Uvaria pirifolia Reinw. ex Koorders, Exkursionsfl. Java 2: 243, as synonym. 1912.

Schizostigma axillare Hook. f. & Thoms. ex Merr. Enum. Phil. Fl. Pl. 2: 153, sphalm. 1923.

Glabrous throughout, monoecious or possibly sometimes dioecious; young branchlets dark purpurascent or brownish, rugulose 1–2.5 mm. in diameter, the older ones brownish to cinereous, subterete or obscurely angled, up to 3–4 mm. in diameter; bud-scales fugacious; leaves 4–14 per annual shoot; petioles slender (0.7–1 mm. in diameter), 7–17 mm. long; leaf-blades chartaceous, when dried dark brown above and slightly paler beneath, lanceolate or ovate-lanceolate, 5–10 cm. long, 1.7–4 cm. broad, subacute to subrounded at base and obscurely decurrent on the petiole, gradually narrowed to an acute callose-apiculate apex 5–10 mm. long, usually entire and narrowly recurved at margin (young leaves sometimes remotely denticulate with minute teeth), the costa plane or shallowly impressed above, prominent beneath, the secondary nerves 5–7 per side, subspreading, prominulous on both surfaces, freely anastomosing, the veinlet-reticulation slightly prominulous on both sides or nearly plane above; flowers solitary or rarely paired, the subtending bracts few, papyraceous, deltoid, 1–1.5 mm. long; ♂ flowers: pedicels 3–12 mm. long at anthesis, 0.7–1 mm. in diameter, 1–3-bracteolate, the bracteoles papyraceous, deltoid-suborbicular, sparsely ciliolate, 1–1.5 mm. long; perianth-segments 9–12, several-seriate, the outer ones papyraceous and minutely ciliolate, the inner ones thin-carnose, the outermost 3 or 4 bracteole-like, 2–4 mm. long and broad, the largest ones elliptic, sometimes ciliolate and obscurely pellucid-glandular, up to 10 mm. long and broad, the innermost 3 or 4 suborbicular to obovate, reduced in size; androecium subglobose, 3.5–5.5 mm. in diameter, the 8–15 stamens 2- or 3-seriate, at length free and reflexed, the connective deltoid, essentially eglandular, the thecae 0.7–0.9 mm. long; ♀ flowers: pedicels and perianth essentially as those of ♂ flowers but segments up to 14 in number; gynoecium subglobose, 3–4 mm. in diameter at anthesis, the torus conical, the carpels 4- or 5-seriate, about 25–35, the ovary obovoid-ellipsoid, at anthesis about 1.2 × 0.8–1 mm., the stigmatic crests somewhat distal in position, the pseudostyle minute, often only 0.1 mm. long, the proximal extension also minute; fruiting pedicel short, not much enlarged, the torus elongating to 5 cm. [ex Koorders, but probably longer at maturity], with 15–20 maturing carpels, these carnose, subglobose, smooth, slightly contracted at base [ex Blume].

TYPE LOCALITY: In the original publication Blume gives the locality of his type specimen as: "in sylvis altis montis *Tjerimai* Provinciae Cheribon." This is found on recent maps as Goenoeng Tjareme, at about lat. 6°55′ and long. 108°25′ in West-Java.

DISTRIBUTION: Java and Sumatra. See map, *fig. 21.* According to Koorders (in 1912), altitudes of 400–2300 m. have been recorded in Java.

SUMATRA: RES. SUMATRA'S WESTKUST: Goenoeng Singgalang, *O. Beccari 367* (K).

JAVA: OOST-JAVA: Tengger, near Ngadisari, *S. H. Koorders 37673* (K). WEST-JAVA: Goenoeng Tjareme, *C. L. Blume* (TYPE COLL., K, NY).

LOCAL NAMES and COLOR NOTES: Koorders (in 1912) records the local names as *Aröj hunjur buut, Patjetan,* and *Patjetan ojod,* and states that the flowers have been recorded as red, purple, or yellowish white. I suspect that in this respect *S. axillaris* is like many other *Schisandrae,* with greenish or yellowish outer perianth-segments and reddish inner segments and androecium. Blume observed both flowers and fruits in October. The Beccari specimen bore flowers in June or July.

Synonymy: In proposing the binomial *Schizandra axillaris,* Hooker & Thomson applied it to Himalayan specimens, upon which their brief description is doubtless based; nevertheless this binomial stands for the Javanese plant originally described by Blume.

Sphaerostema pyrifolium is based upon a specimen collected by Reinwardt "in saltibus provinciae Tjanjor" [Tjiandjoer, West-Java]. Since its proposal, this species has been accepted by only a few authors, who have merely mentioned it without giving a reason for maintaining it. It is definitely reduced to the synonymy of *S. axillaris* by Koorders (in 1912). I believe this to be its proper disposition. Blume's plates and descriptions of his two species (13) do not show any appreciable differences between them, the character of the leaf-base being fairly variable in *Schisandra.* In contrasting *Sphaerostema pyrifolium* with *S. axillare,* Blume (13: 16) remarks only: "Differt enim parumper a praecedente foliis firmioribus basi plerumque rotundatis, pedunculisque longioribus tantummodo in medio unibracteolatis, . . ."

In discussing the composition of § *Sphaerostema,* above, I mentioned the difficulties in distinguishing *Schisandra axillaris* from the continental *S. propinqua;* the rather unsatisfactory differentiating characters are utilized in my key to species. In herbaria and literature *S. axillaris* is frequently attributed a much wider range than is justifiable. As noted elsewhere in this paper, most of the continental specimens identified as *S. axillaris* are referable to *S. propinqua* var. *intermedia;* some of the Malaysian specimens so identified are referable to *Kadsura scandens* and other *Kadsurae.*

24. **Schisandra** (§ *Sphaerostema*) **propinqua** (Wall.) Baill. Hist. Pl. **1**: 148, as *Schizandra p.* 1868–69.

Glabrous throughout, monoecious or sometimes apparently dioecious; branchlets brownish, the younger ones rugulose or striate, 1–3 mm. in diameter, the older ones often becoming grayish, subterete, 2–5 mm. in diameter; bud-scales several, papyraceous, fugacious, the largest ones oblong, up to 10 × 5 mm.; leaves 4–20 per annual shoot; petioles slender (0.7–1.5 mm. in diameter), 5–17 (–22) mm. long; leaf-blades chartaceous or papyraceous, when dried brown above and somewhat paler beneath, lanceolate or elliptic-lanceolate or narrowly ovate-oblong (sometimes linear in var. *sinensis*), (4–) 5–13 (–16) cm. long, 0.8–5 (–6.5) cm. broad, obtuse or rarely rounded at base, seldom decurrent on the petiole, gradually narrowed at apex (acumen usually 5–15 mm. long, subacute, callose-thickened), denticulate or remotely serrulate at margin (variable, the teeth sometimes obvious, 1–3 per centimeter or fewer) or sometimes subentire, the costa plane to shallowly impressed above, elevated beneath, the principal secondary nerves 4–10 per side, erecto-patent (often ascending in var. *sinensis*), sharply raised on both sides or nearly plane above, anastomosing (often intricately so) toward margin, the veinlets copiously reticulate, prominulous on both sides or nearly plane above; flowers usually solitary, sometimes paired, occasionally in clusters of 3–5, the subtending bracts few, papyraceous, minute, fugacious; ♂ flowers: pedicels terete, 3–23 mm. long, 0.4–1.5 mm. in diameter at anthesis, 1–4-bracteolate, the bracteoles scattered, papyraceous to submembranaceous, suborbicular to oblong-deltoid, 1–5 × 1–2.5 mm.; perianth-segments 6–10, 3- or 4-seriate, the outer few membranaceous to papyraceous, elliptic to suborbicular, bracteole-like but increasing in size inward, the inner ones papyraceous to thin-carnose, the largest ones suborbicular to elliptic or obovate, 4.5–9 × 2–9 mm., the innermost 1–4 decreasing in size; androecium subglobose, 3–6 mm. in diameter, the stamens at length free and reflexed; stamens 6–16, the connectives often copiously pellucid-glandular, the thecae 0.5–0.8 mm. long; ♀ flowers: pedicels 5–26 mm. long and 0.7–2 mm. in diameter at anthesis, bracteolate as the ♂; perianth-segments 8–16, essentially similar to those of ♂ flowers but the largest ones in var. *typica* up to 9–15 × 7–11 mm., the innermost 4–6 reduced in size; gynoecium ellipsoid to ovoid-subglobose, 3–6 mm. in diameter at anthesis, the column 2–4

mm. long and 1–2 mm. in diameter; carpels 25–45, 3–7-seriate, ellipsoid or obovoid, the ovary at anthesis 1.2–2.3 mm. long and 0.7–1.3 mm. broad, often copiously glandular, the stigmatic crests conspicuous, membranaceous, distally produced into a pseudostyle 0.4–1 mm. long, proximally extended into 1 or 2 obvious irregular appendages; fruiting pedicels not much enlarged, the torus elongating to 3–15 cm., 1–3 mm. in diameter, with 10–45 maturing carpels; carpels at maturity ellipsoid to subglobose, 6–10 × 5–7 mm., the seeds subglobose- or ellipsoid-flattened, 3.5–5 × 3–4.5 × 2–3 mm., the hilar indentation inconspicuous, the hilar scar obvious.

TYPE LOCALITY: In his original publication of *Kadsura propinqua,* Wallich states: "Observavi in monte Sheopore, rariusque in collibus ad Sankoo, Napaliae." I have been unable to locate a Mt. Sheopore, but Sanku iş situated at lat. 27°43′ and long. 85°15′, just east of Katmandu. Although no collection number is cited in the original publication, Wallich later, in his Catalogue, lists only no. 4986 as representing *Sphaerostema propinquum;* this may be taken as the type collection and as such it is cited under my var. *typica.*

DISTRIBUTION: Central China (Hupeh, southern Shensi and Kansu, and southwestward) to central Burma and Himalayan India westward to United Provinces.

The abundant specimens referable to *S. propinqua* are obviously very diverse, and the question as to the quality of the differences arises; the population seems too variable to permit its retention as an undivided specific entity. If only the extreme geographical forms of the species were available, one would hardly hesitate to recognize two species. The eastern part of the population is characterized by its narrow leaf-blades with coarse serration, its comparatively few and narrow perianth-segments in the ♂ flower, its few stamens, etc. The western part of the population has inconspicuously toothed and comparatively broad leaf-blades, broad perianth-segments, more numerous stamens, etc. There are also differences in the comparative size of the ♀ flowers and fruits. The eastern entity is usually segregated as var. *sinensis,* but if one should elevate it to specific rank the binomial *Embelia Valbrayi* H. Lév. would have to be utilized.

Between these two extremes, both geographically and morphologically, is a considerable population which is intermediate in many of its characters. Its leaf-blades tend to be less obviously toothed and broader than those of var. *sinensis,* but it retains the characteristic ♂ flower of that variety, with some modification. In view of the gradual transition from extreme to extreme, and in view of the reasonably dependable geographical circumscription of the parts of the population, I believe that *S. propinqua* may best be retained as a single specific entity with three varieties as outlined above and as described below. The intermediate variety is the element which has been passing in herbaria as the continental form of *S. axillaris;* I now refer it to *S. propinqua* var. *intermedia.*

KEY TO THE VARIETIES

Leaf-blades lanceolate or narrowly ovate-oblong, usually 7–13 × 2.5–5 cm.; pedicels comparatively stout, of ♂ flowers 3–16 mm. long and 0.7–1.5 mm. in diameter, of ♀ flowers 5–13 mm. long and 0.7–2 mm. in diameter; perianth-segments of ♂ flowers 9 or 10, the largest ones suborbicular, 5–9 × 4–9 mm.; stamens 10–16; ♀ flowers often larger than the ♂, the largest perianth-segments 9–15 × 7–11 mm.; fruit comparatively robust, the torus up to 15 cm. long and 3 mm. in diameter; northern India (United Provinces, Nepal, and (?) Sikkim) .....a. var. *typica.*

Leaf-blades as in var. *typica,* usually 6–10 × 2–4 cm.; pedicels essentially as in var. *sinensis;* perianth-segments of ♂ flowers 7–10, in shape like those of var. *sinensis;* stamens usually 9–12; ♀ flowers and fruit essentially as in var. *sinensis;* Yünnan, northern Burma, and Assam .....b. var. *intermedia.*

Leaf-blades linear to narrowly lanceolate or narrowly ovate-oblong, usually 5–12 × 0.8–3 cm.; pedicels comparatively slender, of ♂ flowers 4–23 mm. long and 0.4–1 mm. in diameter,

of ♀ flowers 5–26 mm. long and 0.7–1.5 mm. in diameter; perianth-segments of ♂ flowers 6–9, the largest ones elliptic, 4.5–8 × 2–6 mm.; stamens 6–9; ♀ flowers hardly larger than the ♂, the largest perianth-segments 5.5–9 × 4–7.5 mm.; fruit comparatively slender, the torus usually not exceeding 7 cm. in length and 1 mm. in diameter; Shensi and Hupeh westward to Sikang and Yünnan .....c. var. *sinensis*.

24a. **Schisandra propinqua** var. **typica** nom. nov.

Kadsura propinqua Wall. Tent. Fl. Napal. 11. *tab. 15.* 1824; G. Don, Gen. Syst. **1:** 102. 1831; Dietr. Syn. Pl. **3:** 307. 1843; Walp. Rep. Bot. Syst. **2:** 16. 1845.

Cadsura propinqua Wall. ex Spreng. Syst. Veg. **4** (2): 345. 1827.

Sphaerostema propinquum Bl. Fl. Jav. [Schizandr.] 15. 1830; Wall. Cat. n. 4986. 1832; Lindl. in Bot. Reg. **20:** *pl. 1688,* 1834; Hook. in Curtis's Bot. Mag. **77:** *tab. 4614.* 1851; Lem. in Jard. Fl. **2:** *pl. 201.* 1852; "J. B." in Cottage Gard. **8:** 327. *f.,* as *S. propinqua.* 1852; Hook. f. & Thoms. Fl. Ind. **1:** 85. 1855; Walp. Ann. Bot. **4:** 79. 1857; Morren & de Vos, Ind. Bibl. Hort. Belg. 437. 1887.

Schizandra propinqua Baill. Hist. Pl. **1:** 148. *f. 183, 184.* 1868–69; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1:** 45. 1872; Hemsl. in Garden **8:** 271. 1875; Nichols. Ill. Dict. Gard. **3:** 383. 1887; King in Ann. Bot. Gard. Calcutta **3:** 220. *pl. 41, A.* 1891; Parment. in Bull. Sci. Fr. & Belg. **27:** 236, 310. *pl. 8, f. 8.* 1896; Kanj. For. Fl. School Circ. N.-W. P. 15. 1901; Rehder in Bailey, Cycl. Am. Hort. **4:** 1625. 1902; Brandis, Indian Trees 9. 1906; Kanj. For. Fl. Siwalik and Jaunsar For. Div. 34. 1911; Rehder in Bailey, Stand. Cycl. Hort. **6:** 3110. 1917; Osmaston, For. Fl. Kumaon 9. 1927.

Schisandra propinqua Hook. f. & Thoms. ex Schneid. Ill. Handb. Laubholzk. **1:** 341. 1905; Rehder, Man. Cult. Trees and Shrubs 260. 1927, ed. 2. 255. 1940.

Plant comparatively robust; leaf-blades lanceolate or narrowly ovate-oblong, usually 7–13 cm. long and 2.5–5 cm. broad; pedicels of ♂ flowers at anthesis 3–16 mm. long and 0.7–1.5 mm. in diameter; perianth-segments (♂) 9 or 10, the largest ones suborbicular, nearly as broad as long, 5–9 × 4–9 mm.; stamens 10–16; pedicels of ♀ flowers at anthesis 5–13 mm. long and 0.7–2 mm. in diameter; perianth-segments (♀) 11–16, the largest ones broadly elliptic or suborbicular or obovate, 9–15 × 7–11 mm.; gynoecium at anthesis often 4–6 mm. long and broad; fruit comparatively robust, the pedicel short, up to 3 mm. in diameter, the torus up to 15 cm. long, usually with 30–45 maturing carpels.

TYPE LOCALITY: As noted above under the species.

DISTRIBUTION: Himalayan India, from Sikkim (?) or Nepal westward to the northwestern part of United Provinces, at altitudes usually recorded as 1200–1800 m. Kanjilal (in 1901) remarks that the plant is "very scarce"; it certainly appears in herbaria less frequently than *S. grandiflora,* from the same general region. See map, *fig. 16.* I have seen no specimens of *S. propinqua* from Sikkim, but in Curtis's Bot. Mag. **77:** *tab. 4614,* it is stated that "Dr. Hooker found it frequent at from 7–9,000 feet in Sikkim-Himalaya." It would seem that this statement should be supported by specimens at Kew; since this is not the case the record must remain doubtful for the time being.

INDIA: Without data, *"H. K.,"* July 1851 (K). NEPAL: "Monte Sheopore, rariusque in collibus ad Sankoo" [Sanku], *N. Wallich 4986* (TYPE COLL., K); Jhikrarra, Doti District, *Bis Ram 423* (A, NY); without definite locality, *N. Wallich* (GH, K). UNITED PROVINCES: Kumaon Division: Garhwal, Herb. Falconer 80 (GH, K); Shaidevi, *R. Strachey & J. E. Winterbottom 2* (GH, K); Dehra Dun District: Chakrata, *C. S. Chand 2* (UC); Mussooree, *C. S. Rawat 4* (A), *M. L. Punj 4* (NY); Mundali, *B. C. Datta 2* (A); Jaunsar District: Korwa Forest, *U. Kanjilal 750* (K); Karwapani, Siwalik & Jaunsar Divisions, *T. M. Ghosh 2* (US).

COLOR NOTES, etc.: The flowers, at anthesis from May to July, are usually portrayed as having the outer perianth-segments greenish, the inner segments and the androecium yellow or pale yellow. Wallich, however, in his original publication, notes that the flowers "are at first pale yellow, but become afterwards deep orange-colored, especially the inner leaflets." The red or purplish fruits are mature in October or November, or perhaps earlier. The only local name I have noted is *Agali* (by Osmaston, in 1927); the fruits are said to be edible.

Several colored plates of *S. propinqua* (var. *typica*), based on cultivated plants,

were published about the middle of the last century, but no herbarium specimens taken from cultivated plants are available to me.

24b. **Schisandra propinqua** var. **intermedia** var. nov.

Sphaerostema axillare sensu Hook. f. & Thoms. Fl. Ind. **1**: 86. 1855; Drury, Hand-book Ind. Fl. **1**: 649. 1864; Walp. Ann. Bot. **4**: 79. 1857; non Bl.

Schizandra axillaris sensu Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 45, quoad specim. et descript., exclud. basonym. 1872; King in Ann. Bot. Gard. Calcutta **3**: 220. *pl. 74, A.* 1891; Brandis, Indian Trees 9. 1906; Kanj., Kanj., & Das, Fl. Assam **1**: 28. 1935; non Hook. f. & Thoms. quoad basonym.

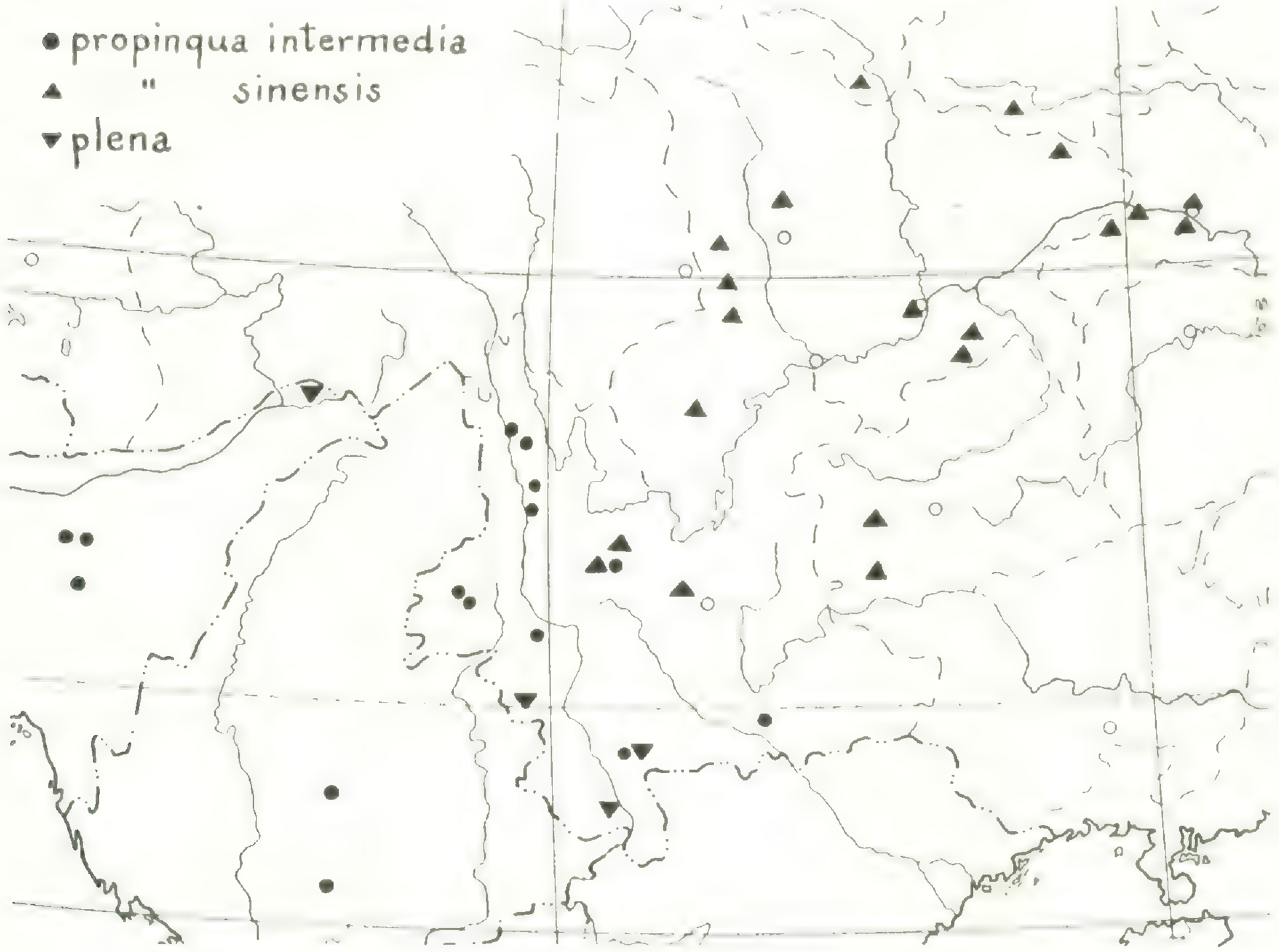

FIG. 28. Approximate known distribution of *Schisandra propinqua* vars. *intermedia* and *sinensis* and *S. plena*. The localities for *S. propinqua* var. *sinensis* in southern Shensi and Kansu are only approximate, as the references from which they are taken are not exact.

Schisandra propinqua sensu Rehder & Wilson in Sargent, Pl. Wils. **1**: 416, p. p. 1913; non Baill.

Schizandra propinqua var. *sinensis* sensu Hand.-Maz. Symb. Sin. **7**: 245. 1931; non Oliv.

Schizandra propinqua sensu Kanj., Kanj., & Das, Fl. Assam. **1**: 28. 1935; non Baill.

Planta quam var. *sinensi* robustior; laminis ut eis var. *typicae*, (4–) 6–10 (–16) cm. longis, (1.5–) 2–4 (–6.5) cm. latis; floribus ♂ eis var. *sinensis* similibus sed segmentis perianthii 7–10 et staminibus saepe 11 vel 12; floribus ♀ fructibusque plus minusve eis var. *sinensis* similibus. FIG. 29, a–c.

TYPE LOCALITY: West of T'eng-yüeh, Yünnan; *Forrest 7692*, one of the best ♂ specimens available, is designated as the type.

DISTRIBUTION: Yünnan to central Burma and Assam, at recorded elevations of 820–2800 m., in thickets, mixed forests, or scrub. See map, *fig. 28.*

CHINA: YÜNNAN: "Kou ty," Pai-yen-ching, *S. Tén 296* (A), *540* (A, US); vicinity of "Yun-nan-sen" [Hsiang-yün Hsien], *E. E. Maire 196* (UC), *1647* (K); "Tchong chan,"

Hsiang-yün Hsien, *F. Ducloux 468* (NY, UC); K'ang-p'u, Wei-hsi Hsien, *H. v. Handel-Mazzetti 10017* (A, K), *C. W. Wang 64229* (A); between Yangtze and Mekong Rivers, near "Schuba," *H. v. Handel-Mazzetti 8820* in part (K); Chien-ch'uan-Mekong Divide, *G. Forrest 21523* (A, UC, US), *22245* (A, K); Shang-p'a [Pi-chiang], *H. T. Tsai 54643* (A); Salwin Valley, *T. T. Yü 22054* (A); outskirts of lava bed west of T'eng-yüeh, *G. Forrest 7686* (A, K), *7692* (A TYPE, K), May 1912; south of T'eng-yüeh, *G. Forrest 11845* (A, K, UC); Shun-ning, "Wenkuankuai," *T. T. Yü 16315* (A); Meng-tzu, *A. Henry 10719* (A, K, M, NY, US); Ssu-mao, north mountains, *A. Henry 13023* (A, K, NY); "Tchen mo," *S. Tén 391* (A); without definite locality, *G. Forrest 14222* (A, K), *15860* (A, K), *19125* (A, K), *H. T. Tsai 57088* (A).

BURMA: MANDALAY: Maymyo Plateau, *J. H. Lace 5432* (K), *5875* (K); Sakangyi Reserve, near Maymyo, *J. H. Lace 5919* (K); Pagan Chaung, Maymyo District, *C. E. Parkinson 3133* (K); Singaungle, Maymyo District, *Collector? 12176* (K). FEDERATED SHAN STATES: Kalaw, *F. G. Dickason 5076* (A). "Shan Hills," *H. Collett 774* (K).

INDIA: ASSAM: Khasi region, *T. Lobb* (K), *J. D. Hooker & T. Thomson* (GH, K, NY), July 13, 1850 (K); "Myrong," Khasi region, *J. D. Hooker & T. Thomson 1564* (K).

CULTIVATED: *Wallich 4987B* (K) (Bot. Gard. Calcutta, originally from Silhet, Assam).

COLOR NOTES: Collectors seem to have found extraordinarily diverse ways of describing the flowers of this variety; most of them have received the impression of a yellowish or dull white flower flushed with red, purple, or crimson. Hooker & Thomson note: "perianth segments dirty white, red toward center; androecium like a strawberry." Probably the perianth-segments become progressively deeper in color inward, while the androecium is reddish. The flowers are often recorded as fragrant; they apparently mature between May and July. The fruits are mature by September or perhaps earlier.

SYNONYMY: This is the form which many authors, following Hooker & Thomson, have referred to *S. axillaris,* which I consider limited to Java and Sumatra. The other references cited in my synonymy are based on specimens which I consider to represent the new variety.

The relationships of var. *intermedia* to the other two varieties of *S. propinqua* are outlined in my key above. It should be noted that certain specimens from Burma, from the vicinity of Maymyo, suggest *S. plena* at a first glance in the size of their leaves, but they do not have the intricate leaf-venation of that species (described below). Additional flowering material of this complex from Burma is desired.

24c. **Schisandra propinqua** var. **sinensis** Oliv. in Hook. Ic. Pl. **18:** *pl. 1715,* as *Schizandra p.* var. *s.* 1887; Rehder & Wilson in Sargent, Pl. Wils. **1:** 416. 1913; Rehder in Jour. Arnold Arb. **5:** 147. 1924, Man. Cult. Trees and Shrubs 260. 1927, ed. 2. 255. 1940.

Schizandra propinqua var. *sinensis* Oliv. ex Maxim. in Acta Hort. Petrop. **11:** 39. 1889; Diels in Bot. Jahrb. **29:** 322. 1900, in Bot. Jahrb. **36:** beibl. 82: 39. 1905; Rehder in Bailey, Stand. Cycl. Hort. **6:** 3110. 1917, in Jour. Arnold Arb. **10:** 191. 1929.

Schizandra propinqua var. *linearis* Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 51. 1905 [repr. Contr. Fl. As. Or. **2:** 51. 1907].

Embelia Valbrayi H. Lév. Cat. Pl. Yun-Nan 177. 1916.

Plant comparatively slender; leaf-blades linear, narrowly lanceolate, or narrowly ovate-oblong, usually 5–12 cm. long and 0.8–3 (–4.5) cm. broad; pedicels of ♂ flowers at anthesis 4–23 mm. long and 0.4–1 mm. in diameter; perianth-segments (♂) 6–9, the largest ones oblong-elliptic or elliptic, longer than broad, 4.5–8 × 2–6 mm.; stamens 6–9; pedicels of ♀ flowers at anthesis 5–26 cm. long and 0.7–1.5 mm. in diameter; perianth-segments (♀) 8–11, the largest ones elliptic, 5.5–9 × 4–7.5 mm.; gynoecium at anthesis usually 3–5 mm. long and broad; fruit comparatively slender, the pedicel often less than 1 mm. in diameter, the torus usually 3–7 cm. long and with 10–30 maturing carpels. FIG. 29, j–l.

TYPE LOCALITY: Vicinity of I-ch'ang, Hupeh; four collections of Henry are originally cited, and below I list these as cotypes.

DISTRIBUTION: Central China, from Hupeh and southern Shensi and Kansu to Kweichow and central Yünnan, in forests or on rocky places or slopes. See map, *fig. 28.* Usually altitudes of 600-2000 m. are reported, but several of Maire's collections record elevations of

2400–3100 m. I have not seen material of this entity from Shensi or Kansu, but the identifications of Maximowicz (in 1889) and Diels (in 1900) are doubtless reliable, since the variety is well known in adjacent Szechuan.

CHINA: HUPEH: Vicinity of I-ch'ang, *A. Henry 1544* (GH, K COTYPE; also cotype coll. of *S. propinqua* var. *linearis*), *1693* (K COTYPE, US), *2028* (K COTYPE; also cotype coll. of *S. propinqua* var. *linearis*), *3243* (K COTYPE, US), *3354* (K), *3961* (cotype coll. of *S. propinqua* var. *linearis*, GH, K, NY), *W. Y. Chun & S. S. Chien 5127* (*8090*) (UC); Ch'ang-yang Hsien, *A. Henry 6219* (cotype coll. of *S. propinqua* var. *linearis* [cited as *62119*], GH, K, US), *E. H. Wilson 485* (A, GH, K, US); Pa-tung Hsien, *A. Henry 3699* (GH, K), *H. C. Chow 567* (A, NY), *898* (A, NY); Chien-shih Hsien, *H. C. Chow 1439* (A); western Hupeh, *E. H. Wilson 1304* (cotype coll. of *S. propinqua* var. *linearis*, A, K, NY), *1565* (K). SZECHUAN: Ch'ung-ch'ing, *E. Faber 781* (K); north of Ch'eng-tu plain, *F. T. Wang 22166* (A); "Tsing-chuan" Hsien, *F. T. Wang 22314* (A); Mu-pin, *E. H. Wilson 1070* (A, K, US); Ya-an Hsien, *C. Y. Chiao 1163* (A); Wa Shan, *E. H. Wilson 1268b* (A, K, US); near Ning-yüan, *H. v. Handel-Mazzetti 1934* (A); Yu-ch'i-k'ou, *H. Smith 2366* (A); without definite locality, *K. K. Tsoong 3530* (Man). KWEICHOW: West of Chen-ning Hsien, "inter opp. Muyn et pontem Balingtjian," *H. v. Handel-Mazzetti 119* (A); Huang-ts'ao-pa, *J. Esquirol 1555* (K); without definite locality, *J. Esquirol 116* (K). YÜNNAN: Lu-feng Hsien, *H. T. Tsai 53549* (A); vicinity of Hsiang-yün Hsien, *E. E. Maire 1720* (K); "Tong-tch'ouan," *E. E. Maire 3650* (UC); "rochers de La-Kou," *E. E. Maire*, July–Sept. 1912 (type coll. of *Embelia Valbrayi*, A); "La-Kou," *E. E. Maire 2023* (NY, UC); "Ma-ch'ou," *E. E. Maire 91* (A).

CULTIVATED: Arnold Arb. 7414 (A) (from seeds of *Wilson 1070*).

LOCAL NAMES and COLOR NOTES: According to Wilson, the variety is known in Hupeh as *Shui-hu-têng* or *Hsueh-hu-têng;* Diels (in 1900) records the names *T'ie-ku-san, Hsiao-hsüe-t'êng,* and *Hsüe-hu-t'êng.* The perianth-segments appear to be greenish to yellow or yellow-orange (deepening in color inward), and the androecium is pale pink to purple. Anthesis occurs between June and August, and the red to scarlet fruits are mature from August to November.

SYNONYMY: *Schizandra propinqua* var. *linearis* is based upon several Hupeh collections of Henry and Wilson and one Szechuan collection of Farges. The Hupeh collections are cited above, and two of them are the same numbers as cotypes of var. *sinensis,* which entity Finet & Gagnepain had obviously overlooked.

Embelia Valbrayi is based upon the Maire specimen cited above, from "La-Kou," Yünnan. Fortunately the identity of this with *S. propinqua* var. *sinensis* was noted by Rehder (in 1929), and an available type duplicate bears out his opinion.

25. **Schisandra** (§ *Sphaerostema*) **plena** sp. nov.

Schisandra propinqua sensu Rehder & Wilson in Sargent, Pl. Wils. **1**: 416, p. p. 1913; non Baill.

Planta ubique glabra ut videtur dioica; ramulis hornotinis fusco-purpurascentibus ruguloso-striatis 1–3.5 mm. diametro, annotinis fusco-cinereis subteretibus ad 5 mm. diametro; foliis plerumque 8–15 per ramulum hornotinum, petiolis (10–) 12–25 mm. longis 1–2.5 mm. diametro; laminis chartaceis vel papyraceis in sicco utrinque fusco-olivaceis vel supra fuscis, elliptico- vel ovato-oblongis raro sublanceolatis, (7–) 8–17 cm. longis, (3–) 5–8.5 cm. latis, basi obtusis vel subrotundatis, in acuminem 5–15 mm. longum calloso-apiculatum attenuatis vel cuspidatis, margine integris vel obscure et remote calloso-denticulatis, costa supra plana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 5–7 arcuato-adscendentibus supra prominulis subtus elevatis, rete venularum copioso et conspicue anastomosante utrinque prominulo; floribus axillaribus vel e ramulis hornotinis infra folia ortis, solitariis vel binis vel interdum in inflorescentiis congestis ramulosis 3–8 aggregatis, bracteis basalibus paucis papyraceis deltoideis minutis (ad 1 mm. longis) fugacibus; floribus ♂: pedicellis gracilibus (ad 0.8 mm. diametro) sub anthesi 4–10 mm. longis, bracteolis 2–4 inconspicuis ut bracteis basalibus raro flores abortivos axillares gerentibus; segmentis perianthii 3–5-seriatis 11–17 omnino papyraceis vel interioribus subcarnosis saepe inconspicue pellucido-glandulosis, extimis deltoideo-oblongis vel oblongis 1.5–6 × 2–5 mm. obscure ciliolatis, maximis obovato-ellipticis 8.5–11 × 3–6 mm., intimis saepe

FIG. 29. *Schisandra* § *Sphaerostema*. *a–c*. *S. propinqua* var. *intermedia*: *a*. ♂ flowering branchlet, × ½; *b*. ♂ flower, × 2; *c*. androecium, × 3. *d–i*. *S. plena*: *d*. ♂ flowering branchlet, × ½; *e*. ♂ flower, × 2; *f*. androecium, × 3; *g*. gynoecium, × 3; *h*. carpel, × 5; *i*. longitudinal section of carpel, × 5. *j–l*. *S. propinqua* var. *sinensis*: *j*. fruiting branchlet, × ½; *k*. mature carpel, × 2; *l*. seed, × 2. *Fig. a* drawn from *Forrest 11845*; *b*, *c* from *Forrest 7692*; *d–f* from *Henry 10854*; *g–i* from *Henry 11893*; *j–l* from *Wilson 485*.

leviter reductis; androecio plerumque obovoideo 4.5–6 mm. longo 3–4 mm. lato basim versus conspicue angustato superne ob projectum cavitatium antheriferorum circularium irregulari, staminibus 5–8 in cavitatibus omnino immersis, connectivo libero nullo, thecis 0.6–1 mm. longis pariete exteriore cavitatium sessilibus; floribus ♀: pedicellis sub anthesi plerumque 5–7 mm. longis et 0.8–1.2 mm. diametro ut ♂ bracteolatis; segmentis perianthii 17–20 ut ♂ subsimilibus; gynoecio subgloboso-ovoideo sub anthesi circiter 4 × 4 mm., carpellis 26–33 eis *S. propinquae* similibus; pedicellis sub fructu maturo ad 15 mm. longis et 1–2 mm. diametro, toro 5–17 cm. longo striato gracili saepe subflexuoso; carpellis maturis plerumque 10–20 ellipsoideo-subgloboso 8–11 × 6–10 mm., seminibus complanato-ellipsoideis 7–7.5 mm. longis et 5.5–6 mm. latis, margine ventrali leviter concavis, testa levi saepe copiose immerso-glandulosa. FIG. 29, d–i.

TYPE LOCALITY: Ssu-mao, Yünnan; *Henry 10854*, the best ♂ specimen available, is designated as the type.

DISTRIBUTION: Southwestern Yünnan and also in extreme northeastern Assam, at altitudes of 600–1500 m., in mixed woods, forests, thickets, or jungle (Ward). See map, *fig. 28.*

CHINA: YÜNNAN: Keng-ma, *C. W. Wang 73145* (A); Ssu-mao, *A. Henry 10854* (A TYPE, NY, US), May 14 [year?]; w. mountains, Ssu-mao, *A. Henry 11893* (A, K, M); s. mountains, Ssu-mao, *A. Henry 11749* (A, K, NY), *12192* (A, K, NY); Ch'e-li Hsien, *C. W. Wang 78784* (A); "Maan-bang, Dah-meng-lung," Ch'e-li Hsien, *C. W. Wang 76340* (A).

INDIA: ASSAM: Delei Valley, *F. K. Ward 8009* (K).

COLOR NOTES: Although Henry reports the flowers as yellow or white, probably the following description of Ward is better: "perianth segments 12, fleshy, pale yellow, the innermost tinged cherry red at the base . . . the cherry red cone of confluent filaments." Mature flowers have been obtained in April and May and mature fruits, which are red or orange-red, in August and September.

As indicated in my key to species, this remarkably distinct species is characterized by its large leaf-blades with very intricate venation, its numerous perianth-segments, and its sessile thecae. Its distribution is very compact with the exception of the Assam specimen, but I have no doubt of the identity of Ward's plant, an excellent ♂ specimen, with the material from Yünnan. The occurrence of the species in Burma and perhaps farther north in Yünnan is to be anticipated.

2. Kadsura

Kadsura Kaempf. ex Juss. in Ann. Mus. Hist. Nat. **16:** 340. 1810; Dunal, Monogr. Anon. 57. 1817; DC. Reg. Veg. Syst. Nat. **1:** 465. 1817, Prodr. **1:** 83. 1824; Wall. Tent. Fl. Napal. 9, p. p. 1824; Reichenb. Consp. 193. 1828; Bl. Fl. Jav. [Schizandr.] 7. 1830; G. Don, Gen. Syst. **1:** 101. 1831; Meisn. Pl. Vasc. Gen. 5. 1836, pars alt. 7. 1843; Endl. Gen. Pl. 835. 1839; Spach, Hist. Nat. Veg. **8:** 8. 1839; Dietr. Syn. Pl. **3:** 215. 1843; Hassk. Cat. Pl. Hort. Bot. Bog. 177. 1844; Hook. f. & Thoms. Fl. Ind. **1:** 83. 1855; Miq. Fl. Ned. Ind. **1** (2): 18. 1858; Benth. & Hook. f. Gen. Pl. **1:** 19. 1862; Drury, Hand-book Ind. Fl. **1:** 647. 1864; K. Koch, Dendr. **1:** 387. 1869; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1:** 45. 1872; Pfeiffer, Nom. Bot. **1:** 1803. 1874; Lauche, Deutsche Dendr. 362. 1880; Nichols. Ill. Dict. Gard. **2:** 214. 1885; Prantl in E. & P. Nat. Pfl. III. **2:** 18. 1888; King in Jour. As. Soc. Beng. **58:** 375. 1889; Boerlage, Handl. Fl. Ned. Ind. **1:** 12. 1890; King in Ann. Bot. Gard. Calcutta **3:** 221. 1891; Trimen, Hand-book Fl. Ceylon **1:** 16. 1893; Dippel, Handb. Laubholzk. **3:** 157. 1893; Koehne, Deutsche Dendrol. 147. 1893; Bailey, Cycl. Am. Hort. **2:** 852. 1900; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 52. 1905 [repr. Contr. Fl. As. Or. **2:** 52. 1907]; Schneid. Ill. Handb. Laubholzk. **1:** 341. 1905; Finet & Gagnep. in Lecomte, Fl. Gén. Indo-Chine **1:** 41. 1907; Koorders, Exkursionsfl. Java **2:** 242. 1912; Dunn & Tutcher in Kew Bull. Add. Ser. **10:** 29. 1912; Bailey, Stand. Cycl. Hort. **3:** 1731. 1915; Ridley, Fl. Malay Penins. **1:** 20. 1922; Rehder, Man. Cult. Trees and Shrubs 260. 1927, ed. 2. 255. 1940; Nakai, Fl. Sylv. Koreana **20:** 107. 1933; Burkill, Dict. Econ. Prod. Mal. Penins. 1275. 1935; Gamble, Fl. Pres. Madras **1:** 9. 1935; Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1:** 57. 1938.

Pulcheria Norona in Verh. Batav. Gen. **5:** Art. 5: 3, nomen. 1790; Hassk. Cat. Pl. Hort. Bot. Bog. 177, as synonym. 1844.

Sarcocarpon Bl. Bijdr. Fl. Ned. Ind. 21. 1825; Spreng. Syst. Veg. **4** (2): 202. 1827; Reichenb. Consp. 86. 1828; Meisn. Pl. Vasc. Gen. 5. 1836, pars alt. 7. 1843.

Cadsura Juss. ex Spreng. Syst. Veg. **2:** 642. 1825, Gen. Pl. **1:** 457. 1830.

Sarcocarpum Bl. ex G. Don, Gen. Syst. **1:** 101. 1831.

Pauslowia Wight ex Arn. in Mag. Zool. and Bot. **2:** 546, as synonym. 1838.

Cosbaea Lem. in Illustr. Hort. **2:** 71. 1855.

Schizandra [Sect.] *Kadsura* Baill. Hist. Pl. **1:** 189. 1868–69.

Panslowia Wight ex Pfeiffer, Nom. Bot. **2:** 581, as synonym. 1874.

Sarcocarposa Bl. ex Parment. in Bull. Sci. Fr. & Belg. **27:** 312, as synonym. 1896.

Kadzura Sugimoto, Key Trees and Shrubs Japan 87. 1936.[1]

Monoecious or sometimes apparently dioecious, usually glabrous throughout, the branchlets terete or subterete, when dried striate-rugulose, usually elongate, the bud-scales papyraceous to coriaceous; leaves alternate, 2–20 per annual shoot, the petioles rugulose when dried, canaliculate, the blades often succulent when fresh, drying coriaceous to papyraceous, opaque to pellucid-glandular, concolorous or slightly paler beneath, pinnate-veined, decurrent on the petiole, usually cuspidate to acuminate at apex, entire or denticulate or serrulate at margin with callose-apiculate teeth, the costa and principal nerves usually obvious; flowers solitary or rarely paired or rarely 2–4-glomerulate, axillary or sometimes arising from ultimate shoots below foliage leaves, rarely a few congested on short lateral branchlets or arising from main branchlets in irregular several-flowered glomerules, the flower-subtending bracts minute, often fugacious; pedicels terete, slightly enlarged distally, rarely ebracteolate, usually with 1–10 scattered bracteoles essentially similar to the subtending bracts; perianth-segments several-seriate, imbricate, 7–24 in number, obviously enlarging inward, the outermost and innermost ones reduced and often modified in texture, those of the middle series usually the largest, elliptic to suborbicular or obovate, usually inconspicuously nerved; androecium various in the different sections, composed of many (13–80) free stamens variously aggregated; stamens in § *Cosbaea* 13–70, several-seriate on a carnose column, this rarely merely rounded, usually elongate-conical and produced into a simple sterile apex or divided into few to numerous linear-subulate appendages, the connective rounded or clavate, with lateral-apical distally contiguous thecae; stamens in § *Eukadsura* and § *Sarcocarpon* 20–80, completely covering the surface of the subclavate carnose column, several-seriate, with essentially sessile anthers, the connectives in § *Eukadsura* transversely oblong-ellipsoid and with strictly lateral thecae, in § *Sarcocarpon* irregularly obovoid and with lateral-dorsal thecae; gynoecium composed of a column and numerous (20–300) several- to many-seriate carpels, the column obovoid to subclavate or ellipsoid, somewhat longer than broad but distinctly narrower at base than distally, the carpels frequently narrowed at base, the ovary ovoid or ellipsoid to obovoid, often angled by mutual pressure, the wall carnose when fresh, often drying coriaceous, uniform in thickness or conspicuously thicker distally than proximally, the stigmatic crests distally produced into a pseudostyle, this subulate or laterally flattened or modified at apex into a peltate or irregular pseudostigma, the stigmatic crests proximally decurrent on the ovary-wall or extended into 1 or 2 irregularly oblong appendages, the locule central or basal, the ovules 2–5 (rarely to 11), collateral to obliquely superposed, ventrally attached or pendulous from the ventral angle; fruit composed of an ellipsoid or clavate torus and carpels aggregated into a subglobose or ellipsoid head, the pedicel often enlarging in fruit; carpels in fruit crowded, subglobose to obovoid or elongate-obovoid, obtuse or pseudostipitate at base, rounded or flattened or convex at apex, the remnants of the pseudostyle or pseudostigma hardly apparent at maturity, the pericarp carnose when fresh, often drying firmly

coriaceous, uniform in thickness or greatly thickened distally; seeds 2–5 (sometimes 1, rarely more than 5), ventrally attached or pendulous, ellipsoid to subreniform or ovoid, the hilar indentation obvious or inconspicuous, lateral (if on long axis) or uppermost (if on short axis of pendulous seeds), the testa brittle, smooth.

TYPE SPECIES: *Kadsura japonica* (L.) Dunal, based on *Uvaria japonica* L. and therefore on Kaempfer's polynomial *Futó Kádsura* . . . etc. of 1712. It should be noted that in proposing the genus *Kadsura* Jussieu did not form a new binomial; this combination was left for Dunal in 1817. The genus, however, was adequately circumscribed by Jussieu in 1810 by a description, a reference to *Uvaria japonica* "Thunb.," and an allusion to Kaempfer's original publication.

DISTRIBUTION: Southeastern Asia (Japan and southern Korea to central China, Sikkim, and peninsular India) and southward in Malaysia to Java and Amboina. See map, *fig. 31.* Twenty-two species are recognized in this treatment.

SYNONYMY: A name which has priority over *Kadsura* Kaempf. ex Juss. is *Pulcheria* Norona, which is found in a list of Javanese plants published in 1790. The entire entry referring to this name is as follows: "'Pulcheria,' [Latyn]. 'Hunsut-buhùt," [Javaansch]. 'Sp. 1.'" *Pulcheria* was apparently first referred to the synonymy of *Kadsura* by Hasskarl in 1844 (cited above), but whether this reduction was based upon examination of a specimen is not stated. At any rate, the similarity of Norona's Javanese name to the numerous local names known for *Kadsura scandens* seems to establish the identity of his *Pulcheria.*

Sarcocarpon Bl. is based upon *S. scandens* Bl., the basonym of *Kadsura scandens.* This generic concept is the foundation of my § *Sarcocarpon,* discussed below.

Pauslowia (or *Panslowia*) Wight is a name which occurs on the labels of *Wight 2478,* the type collection of *Kadsura Wightiana.* The generic name has never been validly published nor used in a binomial; it is further discussed in my consideration of the synonymy of *Kadsura heteroclita.*

Cosbaea Lem., with a single species, *C. coccinea,* is a well-defined concept which I take as the basis of my § *Cosbaea,* discussed below.

Baillon (in 1868–69) combined *Kadsura* and *Schisandra* in a single genus, but only by implication did he create a sectional name for *Kadsura,* as ". . . receptaculo communi demum, aut brevi capitato (*Kadsura*), . . ."

The remaining generic names listed above in synonymy, namely *Cadsura, Sarcocarpum, Sarcocarposa,* and *Kadzura,* are obvious misspellings.

CRITERIA FOR DELIMITATION OF SECTIONS; THEORETICAL PHYLOGENY. Although no sectional division of *Kadsura* has been proposed up to the present, the genus falls into three very sharply marked groups on the basis of androecial characters. That these three groups were recognized by at least some early students, however, is obvious in the fact that two of them were proposed as distinct genera—*Sarcocarpon* Bl. and *Cosbaea* Lem. Recent writers on this group have not concerned themselves with major divisions, and as a result the inter-relationships of species have often been misunderstood.

As in *Schisandra,* there are no vegetative characters in *Kadsura* which can be readily utilized as sectional criteria. Throughout the genus the flowers are characteristically solitary in the axils of leaves on the ultimate shoots, but various modifications of this arrangement occur in all the sections. The occurrence of flowers in clusters on the larger branchlets is rare but is perhaps to be expected in any section. In perianth-characters, § *Cosbaea* is sharply marked from the other two sections by having its largest perianth-segments greatly exceeding the several outermost series in length, a characteristic which gives that section an immediately recognizable aspect but which is hardly fundamental. Throughout *Kadsura* one may expect to find either monoecious or dioecious specimens of the same species; possibly monoeciousness is the rule, and of course one cannot say with certainty that any given specimen is dioecious without dissecting every flower, since

the flowers of the two sexes are externally similar and often contiguously borne on the branchlets.

As in *Schisandra,* gynoecial characters in *Kadsura* do not offer basic sectional criteria, although characters of partial value are indeed apparent in ♀ flowers and fruits. For instance, in § *Cosbaea* the stigmatic crests are always produced into a subulate pseudostyle, while in § *Eukadsura* the pseudostyle is always terminated by a peltate and usually conspicuous pseudostigma. In § *Sarcocarpon,* however, this character varies from species to species, and all variations may be found between the two extreme types. Whereas in *Schisandra* the ovary-wall is more or less uniform in thickness (a character reflected in the uniform pericarp of the fruit), in *Kadsura* this situation is found only in some species of § *Eukadsura.* In § *Cosbaea* and § *Sarcocarpon* the ovary-wall is thicker distally than proximally, and in the fruit this is often reflected by the greatly thickened distal portion of the carpel, the locule and the seeds being toward the base; § *Eukadsura* is inconstant in this respect, some species having a distally thickened pericarp and others having it uniform in thickness as in *Schisandra.* The ovules in *Kadsura* are usually 2 or 3, except in § *Eukadsura,* where some species have 2–5 ovules and one species apparently sometimes as many as 11. The attachment of the ovules is in my observation a constant sectional character: § *Eukadsura* has ventral ovules, while the other two sections have them pendulous from the ventral apical angle. A concomitant difference in the seeds may be observed: § *Eukadsura* has the seeds with a lateral hilum (on the longer axis), while the other sections have the hilum on the uppermost (or shorter) axis. These seed characters, however, are not absolutely dependable, as sometimes crowding modifies the seed-shape, especially at the base of the mature carpel. The testa of the seed in *Kadsura* is always smooth, and therefore no characters of surface-configuration can be utilized as in *Schisandra.*

The characters discussed in the preceding paragraphs are so combined in the three sections that one has no basis for speculation as to the primitiveness of any section, especially as it is by no means clear which characters are comparatively primitive in the ♀ flowers of the Schisandraceae. However, in *Kadsura,* as in *Schisandra,* the fundamental androecial characters are well fixed in each section and would appear to offer the best basis for phylogenetic speculation, if indeed such speculation is not entirely rash in this instance.

In *Kadsura* the stamens are always aggregated, there being two main patterns. In § *Cosbaea* the column is often remarkably modified into a conical organ which may be surmounted by numerous subulate appendages; ordinarily in this section the stamens are borne on the slopes of the androecial cone but are exceeded by its strikingly divided summit. Sometimes, however, the column is merely a rounded cushion which appears to be composed of the fused bases of filaments. In specimens which are beyond doubt referable to a single species, *Kadsura coccinea,* all variations of this androecial type are found. The plasticity of this androecium may suggest that it is more primitive than the androecium of the other two sections, which is highly stereotyped. It is conceivable that the most primitive androecium to be found in *Kadsura* occurs in § *Cosbaea,* and especially in those individuals which have the androecial column small rather than conically produced. Such individuals, indeed, approach very closely in androecial characters to the supposedly "primitive" species of *Schisandra* § *Pleiostema.*

In *Kadsura* § *Eukadsura* and § *Sarcocarpon,* the androecial column (presumably formed by the fusion of filament-bases) is subclavate, with the essentially

sessile anthers closely appressed in a subglobose or ellipsoid head. This type of androecium suggests nothing in *Schisandra*, but upon superficial examination it might be confused with the androecium of *Schisandra* § *Sphaerostema*, a very different organ, as discussed above. Obvious differences between § *Eukadsura* and § *Sarcocarpon* exist in the shape of the anthers. In § *Eukadsura* the connective is much broader than thick, transversely oblong-ellipsoid in shape, and very regular in apical outline. The stamens are arranged in symmetrical whorls, the anthers with their lateral edges contiguous in such a way that adjacent thecae are closely appressed, cleft to cleft. In § *Sarcocarpon*, on the other hand, the connective is about as broad as thick, obovoid in general shape, and somewhat pentagonal in apical outline. The anthers seem to be spiralled on the column, abutting on one another in a rather intricate pattern which does not normally permit the contiguity of any two thecae. The thecae are distinctly dorsal-lateral, being separated by the projecting dorsal angle of the carnose connective. The two types of androecial arrangement here discussed are so obvious and so stereotyped that no possible confusion should exist between § *Eukadsura* and § *Sarcocarpon*.

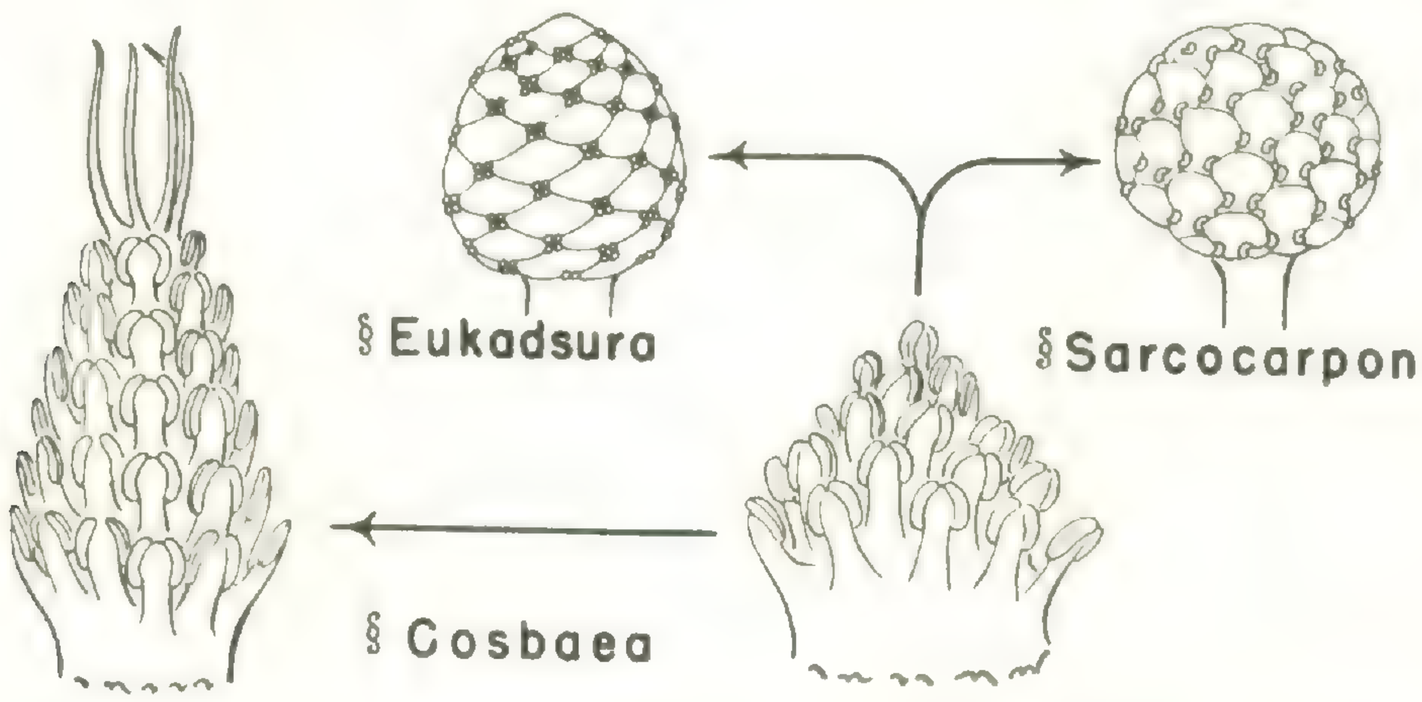

FIG. 30. Theoretical phylogeny of the sections of *Kadsura* based on androecial characters; for explanation see text. All figures × 3.

If one assumes that § *Cosbaea*, at least in individuals which have the androecial cone small, presents the primitive *Kadsura* androecium, the derivation of the other types may be readily hypothecated. A modification of this androecial column into the clavate column of § *Eukadsura* and § *Sarcocarpon* would have been slight and presumably would have been accompanied by a shortening of the free portions of filaments and a great enlargement of the connectives. Concomitantly the swollen connectives would have developed two basic shape-patterns, these patterns giving § *Eukadsura* and § *Sarcocarpon* their respective androecial characteristics. If the assumptions here expressed be actual, the two derivative sections of *Kadsura* were probably developed simultaneously and in a somewhat parallel manner, rather than one of them having been ancestral to the other.

CORRELATION OF GEOGRAPHICAL DISTRIBUTION WITH THEORETICAL PHYLOGENY: The distribution of the three sections of *Kadsura* is as follows:

§ *Cosbaea*. Southern China, Indo-China, Siam, and southern Burma.

§ *Eukadsura*. Japan and Korea across China to Sikkim in India, and thence southward to the Philippines, Indo-China, Sumatra, Ceylon, and peninsular India.

§ *Sarcocarpon*. Indo-China, Siam, Sumatra, and southeastward to the Philippines, Amboina, and Java.

It seems reasonable to assume that *Kadsura* and the closely allied *Schisandra* had their centers of origin within the area delimited above. One may note that the focal point of the three sections of *Kadsura* includes Indo-China and Siam, the only countries in which all the sections are known to occur. Actually not many species are known from these two countries, which is perhaps a reflection upon the amount of collecting done in them.

Although § *Cosbaea* occupies the smallest area of the three sections of *Kadsura* and in my interpretation includes the fewest species, it seems to be the most primitive section on the basis of androecial characters. As mentioned above, it is possible to visualize the evolution of two parallel androecial patterns from a basic § *Cosbaea* type. Geographically the § *Eukadsura* pattern is more northerly than

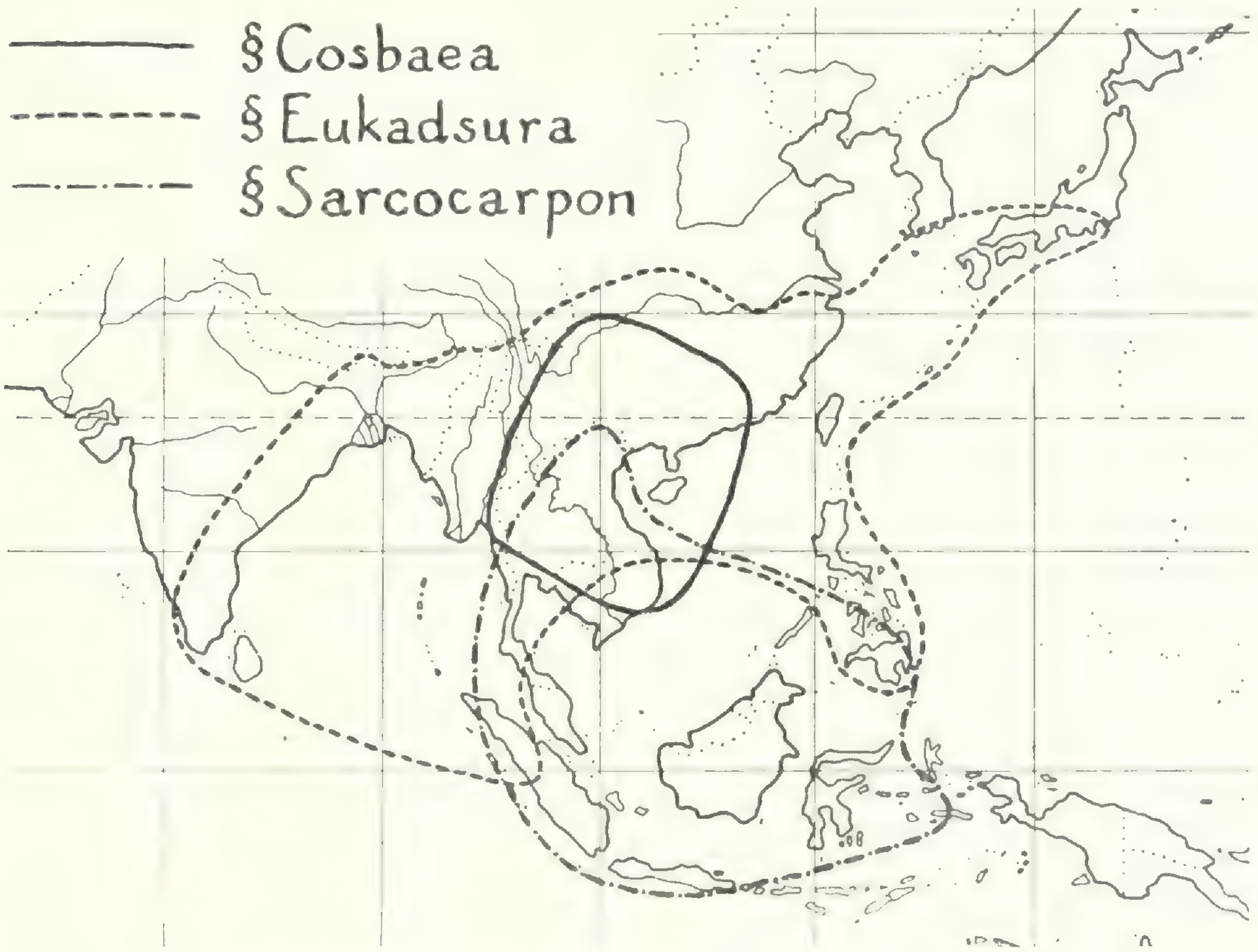

FIG. 31. Generalized distribution of the three sections of *Kadsura*.

the § *Sarcocarpon* pattern, the region of overlap between the two being a narrow strip including the southern Philippines, parts of Indo-China and Siam, and northern Sumatra (see map, *fig. 31*). Concomitant with the evolution of these two androecial patterns, therefore, there may have been a northward and southward expansion of the range of the genus, the two derivative androecial patterns becoming dominant in the extreme parts of the modern range.

KEY TO THE SECTIONS

Androecium composed of a modified column and free stamens, the column conical or elongate-conical (rarely merely rounded), gradually narrowed distally and produced beyond the stamens into a sterile subacute or irregularly divided apex (appendages often numerous, linear-subulate); free portions of filaments obvious, the connective inconspicuous, rounded or clavate, the thecae lateral-apical (sometimes slightly extrorse or introrse), curved,

contiguous at apex, separated at base; carpels with the stigmatic crests produced into a subulate pseudostyle, the locule basal, the ovary-wall greatly thickened distally, the ovules 2 or 3, pendulous; mature carpels greatly thickened distally, the seeds pendulous with the hilar end uppermost, the hilar indentation on the short axis .....§ *Cosbaea.*

Androecium composed of a subclavate column and closely appressed (but free) stamens; free portions of filaments minute, the connective greatly enlarged, the thecae lateral or lateral-dorsal, separated by the width of the connective or at least by its projecting dorsal angle, not contiguous at apex.

Stamens very regularly cyclic, the connective transversely oblong-ellipsoid, the thecae strictly lateral, separated by the entire width of the connective, the thecae of adjacent stamens contiguous and often closely appressed; carpels with the stigmatic crests terminated by an irregularly peltate pseudostigma, the ovary-wall often uniform in thickness, sometimes thickest distally, the ovules 2–5 (rarely to 11), ventrally attached; mature carpels with the pericarp often uniform in thickness or sometimes thickest distally, the seeds (1–) 2–5 (–11), ventrally attached, the hilar indentation on the long axis (except sometimes on the short axis of crowded basal seeds) ..§ *Eukadsura.*

Stamens irregularly cyclic or appearing spiralled, the connective oblong-turbinate or obovoid, irregularly pentagonal at apex, the thecae lateral-dorsal, separated by the projecting dorsal angle of the connective, sometimes subcontiguous at base, the thecae of adjacent stamens not contiguous; carpels with the stigmatic crests produced into a subulate pseudostyle or sometimes terminated by a peltate or irregular pseudostigma, the ovary-wall thicker distally than proximally, the locule often basal, the ovules 2 or 3, pendulous or obliquely pendulous; mature carpels with the pericarp thickest distally, often conspicuously so, the seeds 1 or 2 (or 3), pendulous from the ventral angle with the hilar end uppermost, the hilar indentation essentially always on the short axis .....§ *Sarcocarpon.*

Section Cosbaea

Kadsura sect. **Cosbaea** (Lem.) sect. nov.

Cosbaea Lem. in Illustr. Hort. **2**: 71. 1855.

Flowers with 10–16 perianth-segments, these obviously enlarging inward, the largest ones greatly exceeding the small outermost ones in length; androecium composed of an often highly modified carnose column and 13–70 free stamens, the column (presumably formed by the basal parts of fused filaments) conical or elongate-conical (rarely merely rounded), gradually narrowed distally and produced into a sterile subacute apex, or with apex irregularly divided into 2–15 (–25) linear-subulate appendages, or not produced distally but completely obscured by stamens; stamens ascending, with the free portions of filaments obvious and slightly swollen into the rounded or clavate connective, the thecae lateral-apical, often slightly extrorse or rarely slightly introrse, curved, contiguous at apex, separated at base; carpels 50–80, the stigmatic crests distally produced into a subulate pseudostyle, the locule basal, the ovary-wall much thicker distally than toward base, the ovules 2 or 3, pendulous from the ventral-apical angle; fruiting heads often large, the mature carpels firmly coriaceous when dried (probably soft-carnose when fresh), the pericarp greatly thickened distally, much thinner toward base, the locule basal, the seeds 2 or 3, collateral or collateral-superposed, pendulous with the hilar end uppermost, the hilar indentation on the short axis.

Type species: *Kadsura coccinea* (Lem.) A. C. Sm., based on *Cosbaea coccinea* Lem., the only species of Lemaire's genus.

Distribution: Southern China (including Hainan), Indo-China, Siam, and southern Burma. See map, *fig. 31.* Three species are recognized in this treatment.

Synonymy: The genus *Cosbaea* was properly published and well described and figured, on the basis of a single species; there is no reason for the subsequent ignoring of the name.

The single species of *Cosbaea, C. coccinea,* is obviously identical with *Kadsura chinensis* Hance ex Benth., a fact which has been noted by a few writers, including Baillon. However, the obvious combination in *Kadsura,* based on this oldest specific epithet, has not previously been made. In androecial characters § *Cos-*

baea differs sharply from the other two sections of *Kadsura,* to such a degree, indeed, that the desirability of maintaining the entity as a distinct genus may be contemplated. However, the gynoecial and fruiting characters of *Kadsura* are reasonably consistent, and a theoretical phylogenetic line based on androecial characters can be traced connecting § *Cosbaea* with the other two sections of *Kadsura.* While, therefore, I do not seriously contemplate re-establishing Lemaire's genus, it should be noted that § *Cosbaea* probably more nearly approaches generic stature than any other section of the basic genera *Schisandra and Kadsura.*

Section Eukadsura

Kadsura sect. **Eukadsura** sect. nov.

Kadsura Kaempf. ex Juss. in Ann. Mus. Hist. Nat. **16**: 340, sens. str. 1810.

Flowers with 8–19 perianth-segments, the outermost few obviously or slightly smaller than the largest ones; androecium ovoid or subglobose to obovoid, composed of a subclavate carnose column and 25–80 free stamens (these closely appressed when young but never connate, except as the filaments are fused to form the column); stamens very regularly cyclic, the free portions of filaments minute, the connective carnose, transversely oblong-ellipsoid, the thecae lateral, ellipsoid or oblong-ellipsoid, dehiscing by strictly lateral clefts, the thecae of adjacent stamens contiguous and often closely appressed; carpels 25–80 (–100), the stigmatic crests distally produced into a short pseudostyle which is terminated by an irregularly peltate often membranaceous pseudostigma, the ovary-wall uniform in thickness or thicker distally than proximally, the locule central or basal, the ovules 2–5 (rarely to 11), collateral-superposed, ventral; fruiting heads small to large, the mature carpels coriaceous when dried (probably soft-carnose when fresh), the pericarp uniform in thickness or much thicker distally than proximally, sometimes showing shape of seeds in drying, the seeds (rarely 1) 2–5 (–11), superposed or collateral-superposed, sometimes separated by partial false dissepiments, reniform to ellipsoid, ventrally attached with the hilum lateral, the hilar indentation on the long axis (except sometimes on the short axis of crowded basal seeds).

Type species: *Kadsura japonica* (L.) Dunal, founded upon *Uvaria japonica* L., is the sole basis of *Kadsura* Kaempf. ex Juss., and is therefore the type species of § *Eukadsura.*

Distribution: Japan (central Honshu southward), southern Korea, central China, and Sikkim southward to the Philippines, Indo-China, Sumatra, Ceylon, and peninsular India. See map, *fig. 31.* The section is here taken to include 11 species.

Although the typical section of *Kadsura* is very clearly marked by its androecial characters, as noted above in my discussion of criteria for delimitation of sections, nevertheless specific lines within § *Eukadsura* are often tenuous. Certain species, notably *K. induta, K. oblongifolia, K. angustifolia,* and *K. interior,* stand out by virtue of one or a combination of characters, but the remaining species are established on the basis of averages and trends, coupled with fairly reliable geographical distributions. For further discussion of this problem, see the notes following my description of *K. japonica,* below.

Section Sarcocarpon

Kadsura sect. **Sarcocarpon** (Bl.) sect. nov.

Sarcocarpon Bl. Bijdr. Fl. Ned. Ind. 21. 1825.

Flowers with 7–24 perianth-segments, the outermost few obviously or slightly smaller than the largest ones; androecium ovoid or subglobose to obovoid, composed of a subclavate carnose column and 20–65 free stamens (these closely appressed when young but never connate, except as the filaments are fused to form the column); stamens irregularly cyclic or appearing spiralled, the free portions

of filaments minute, the connective carnose, irregularly oblong-turbinate or obovoid, angled by mutual pressure, irregularly pentagonal at apex, the thecae lateral-dorsal, ellipsoid- or obovoid-oblong, separated by the projecting dorsal angle of the connective but sometimes oblique and subcontiguous at base, the thecae of adjacent stamens not contiguous; carpels 20–300, the stigmatic crests distally produced into a pseudostyle, this sometimes subulate or laterally flattened and sometimes flaring into a peltate or bifid or irregular submembranaceous pseudostigma, the ovary-wall much or slightly thicker distally than proximally, the locule often basal, the ovules 2 or 3, pendulous or obliquely pendulous, essentially collateral; fruiting heads small to large, the mature carpels coriaceous when dried (probably soft-carnose when fresh), the pericarp much or slightly thicker distally than proximally, not showing shape of seeds in drying, the seeds 1 or 2 (or 3), if more than 1 obliquely superposed, pendulous from the ventral angle with the hilar end uppermost, ellipsoid or flattened-subglobose or subreniform, the hilar indentation on the short axis (or rarely on the long axis of a ventrally attached upper seed).

TYPE SPECIES: *Sarcocarpon* was proposed with a single species, *S. scandens* Bl.; five years after proposing the genus, Blume concluded that it should be submerged in *Kadsura* and made the combination *Kadsura scandens* for his own binomial; this entity is the basis of § *Sarcocarpon*.

DISTRIBUTION: From northern Indo-China (1 species), southern Siam, and Sumatra southward and eastward to the southern Philippines, Celebes, Amboina, and Java. See map, *fig. 31*. Eight species are here recognized.

Blume's original concept of *Sarcocarpon* as distinct from *Kadsura* has substantial support in the androecial differences, although this fact was not emphasized by Blume. As pointed out above in my discussion of the criteria for delimitation of sections, the anther-shape is strikingly different in § *Eukadsura* and § *Sarcocarpon*, and within the sections there is no essential variation in this character. In other basic features the distinction between the two sections is less clear, although the distal thickening of the ovary-wall is much more pronounced in § *Sarcocarpon*, the ovules are pendulous rather than ventral, the termination of the pseudostyle is more variable, and the number of ovules more fixed.

KEYS TO THE SPECIES

§ COSBAEA

Leaf-blades usually coriaceous and opaque, not translucent, only rarely (younger leaves) pellucid-glandular, the veinlet-reticulation immersed on both sides, sometimes slightly raised beneath and obscurely so above, the secondary nerves 4–8 per side; base of leaf-blades acute to obtuse; pedicels at anthesis usually 8–30 mm. long; stamens 13–48; southern China (incl. Hainan) and Indo-China .....1. *K. coccinea*.

Leaf-blades comparatively thin, translucent, copiously and obviously pellucid-glandular, the veinlet-reticulation prominulous on both surfaces, the secondary nerves 7–10 per side; base of leaf-blades obtuse or rounded.

Leaf-blades elliptic, usually 10–17.5 × 4–8 cm., obtuse at base, the secondary nerves evenly spaced, those toward base not crowded; pedicels at anthesis 15–22 mm. long; stamens 60–70; Siam .....2. *K. ananosma*.

Leaf-blades broadly ovate, usually 11–13.5 × 7–10.5 cm., rounded or very broadly obtuse at base, the 2 or 3 lowermost secondary nerves spreading from costa near its base; pedicels at anthesis 30–40 mm. long; stamens about 45; southern Burma. 3. *K. calophylla*.

§ EUKADSURA

Branchlets, petioles, lower surfaces of leaf-blades, pedicels, and perianth-segments without brown-pilose; stamens 73–80; Yünnan .....4. *K. induta*.

Plants glabrous throughout; stamens apparently not exceeding 70.
Floral parts comparatively few; perianth-segments 9–12; stamens 30–33; carpels 25–30; leaf-blades serrulate or denticulate, at least distally, with usually obvious teeth; Philippines .....14. *K. paucidenticulata.*
Floral parts more numerous; perianth-segments (rarely 8–) 10 or more, usually more than 12; stamens rarely fewer than 35 (except about 25 in no. 5); carpels 30 or more.
Stamens about 25; carpels 35–50; fruiting heads compact, 1.2–2 cm. in diameter, with mature carpels 5–7 mm. long and seeds 4–4.5 mm. long; leaf-blades usually lanceolate-oblong and 3–4 times as long as broad; pedicels, even in fruit, rarely exceeding 35 mm. in length; Hainan .....5. *K. oblongifolia.*
Stamens (rarely 30–) 35 or more; leaf-blades and fruiting heads various (of species keyed here, only no. 11, with large leaves and fruits, occurs on Hainan).
Carpels 75–80; leaf-blades lanceolate, 3–3.5 times as long as broad, with 8–12 primary nerves per side; Indo-China .....6. *K. angustifolia.*
Carpels 30–60 (except 60–75 in no. 7 and possibly more in no. 12); leaf-blades usually broader than indicated above and with fewer lateral nerves.
Outer perianth-segments not greatly reduced in size, not bracteole-like, the largest segments 13–23 mm. long; carpels 60–75; pedicels, even in fruit, not exceeding 4 cm. in length; Yünnan and Burma .....7. *K. interior.*
Outer perianth-segments conspicuously smaller than the inner, the outermost bracteole-like, the largest observed not more than 16 mm. long; carpels 30–60 (possibly more in no. 12).
Species of Japan, Ryu Kyu Islands, Formosa, and Korea; fruiting carpels at maturity subglobose, 6–10 mm. in diameter, the pericarp carnose, no thicker at apex than proximally, flattening in drying to show shape of seeds; seeds reniform, with an obvious hilar indentation; leaf-blades predominantly elliptic, with the greatest width at about the middle, acute to obtuse at base; pedicels, even of mature fruits, not exceeding 6 cm. in length.
Leaf-blades oblong- or obovate-elliptic, obtusely cuspidate or short-acuminate at apex, usually obviously callose-serrulate at margin; perianth-segments pellucid- or immersed-yellow-glandular, not conspicuously so; seeds castaneous, 5–6 mm. long; Japan, Ryu Kyu Islands, and Korea .....8. *K. japonica.*
Leaf-blades elliptic to lanceolate-oblong, often similar to those of *K. japonica* at apex but sometimes obtuse, often essentially entire at margin, rarely obscurely and remotely serrulate; perianth-segments copiously yellow-glandular without; seeds brown, 4–5 mm. long; Formosa ..9. *K. Matsudai.*
Species of continental Asia (east-central China and India southward), Hainan, Sumatra, and Philippines; fruiting carpels at maturity obovoid, the pericarp thick-carnose and thicker distally than proximally, usually not flattening in drying nor showing shape of seeds; seeds ellipsoid to subreniform, without a pronounced hilar indentation, pale brown to dark castaneous; leaf-blades and pedicels various.
Leaf-blades often obovate-lanceolate, sometimes oblong-elliptic or -lanceolate, usually 7–11.5 cm. long and 2.5–5.5 cm. broad, attenuate to acute or sometimes obtuse at base, usually callose-apiculate or callose-serrulate at margin in the distal two-thirds, rarely obscurely so, with 5–7 secondary nerves; pedicels of ♂ flowers at anthesis 7–45 mm. long, of ♀ flowers 15–105 (–160) mm. long, of mature fruits (15–) 30–130 (–170) mm. long; fruiting heads at maturity 2.5–3.5 cm. in diameter, the carpels 8–14 × 7–11 mm., the seeds 2–5, 5–6.5 mm. long; eastern and south-central China (Chekiang and Anhwei to Szechuan and southward to Kwangtung, Kwangsi, and Kweichow).
10. *K. longepedunculata.*
Leaf-blades ovate- to lanceolate-elliptic or broadly elliptic, usually 8–17 cm. long and 3–8.5 cm. broad, subacute to obtuse at base, usually entire or subentire at margins, sometimes denticulate distally, with 7–11 secondary nerves; pedicels of ♂ flowers at anthesis (1–) 3–20 (–28) mm. long, of ♀ flowers 3–20 (–45) mm. long, of mature fruits 7–30 (–45) mm. long; fruiting heads at maturity 2.5–5 cm. in diameter, the carpels 10–20 × 6–10 mm., the seeds 2–5, 5–7 mm. long; India, Ceylon, southern China (Yünnan and Kweichow to Kwangtung and Hainan), and southward through Indo-China, Siam, and Andaman Islands to Sumatra .....11. *K. heteroclita.*

Inadequately known species of this relationship, with fruiting heads at maturity up to 8 × 6.5 cm.; carpels up to 20 mm. long; seeds 5–11, 6–8 mm. long; leaf-blades elliptic-oblong, usually 8–12 × 3–5.5 cm., entire or remotely callose-denticulate; Szechuan .....12. *K. polysperma.*

Leaf-blades ovate-elliptic, usually 7–10 cm. long and 3–5 cm. broad, rounded to subacute at base, entire or obscurely undulate at margin; pedicels of ♂ flowers at anthesis 8–30 mm. long, of ♀ flowers and mature fruits (8–) 15–50 (–65) mm. long; fruiting heads at maturity about 1.5 cm. in diameter, the carpels 7–8 × 6–7 mm., the seeds 2–4, 4.5–5.2 mm. long; Philippines .....13. *K. philippinensis.*

§ Sarcocarpon

Branchlets copiously and strongly verrucose-lenticellate; leaf-blades elliptic-ovate, 13–20 × 6–10 cm.; ♂ flowers with pedicels 10–20 mm. long, about 17 perianth-segments, and about 30 stamens; Indo-China .....15. *K. verrucosa.*

Branchlets smooth, the larger ones lenticellate but not copiously verrucose; species not known to occur in Indo-China.

Carpels usually numerous, 60 or more (except 35–40 in no. 18), the stigmatic crests terminating in a flaring and stigma-like pseudostyle; stamens 35–65, rarely as few as 22 (in no. 17); leaf-blades, at least on larger branchlets, often broadly ovate and rounded at base.

Perianth-segments 15–20, the largest ones oblong or elliptic-oblong, obviously longer than broad, 13–20 × 7–11 mm.; stamens 38–50; carpels 250–300 (apparently fewer in cultivated specimens); pedicels of ♂ flowers at anthesis 2–7 mm. long, of ♀ flowers 5–15 mm. long; Borneo and southern Philippines .....16. *K. marmorata.*

Perianth-segments in ♂ flowers 10–17, in ♀ flowers 11–24, the largest ones elliptic or obovate-elliptic, not much longer than broad, 8–17 × 5.5–15 mm.; stamens (22–) 35–65; carpels 35–120; pedicels of ♂ flowers at anthesis 6–15 mm. long, of ♀ flowers 11–60 mm. long.

Leaf-blades often gradually acuminate at apex; stamens 0.8–1.5 mm. long, often less than 1.5 mm. broad across apex; carpels 60–120; southern Siam, Malay Peninsula, Sumatra, and Java .....17. *K. scandens.*

Leaf-blades obtusely cuspidate at apex; stamens large, about 2 mm. long and broad; carpels 35–40; Celebes .....18. *K. celebica.*

Carpels 20–50, the stigmatic crests terminating in an inconspicuous subulate or slightly flattened pseudostyle which does not flare into a pseudostigma; stamens 20–45.

Perianth-segments about 7; leaf-blades oblong-elliptic, 9–12.5 × 3–5.2 cm.; Amboina. *22. K. ultima.*

Perianth-segments 8–17.

Leaf-blades oblong- or lanceolate- or ovate-elliptic, 6–11 × 3–5.3 cm., glandular-dotted beneath, the peioles 5–18 mm. long; largest perianth-segments 6.5–11 × 5–8.5 mm.; stamens 23–45; Malay Peninsula and Bangka Island to Borneo ..19. *K. lanceolata.*

Leaf-blades ovate-elliptic or broadly ovate, usually 11–17 × 5.5–11.5 cm., the petioles 12–35 mm. long; largest perianth-segments 9–14 × 6–9 mm.; stamens 20–23; Borneo.

Pedicels of ♂ flowers 2-3 mm. long at anthesis, of ♀ flowers not exceeding 5 mm. in length; leaf-blades drying brown, ovate-elliptic, usually 5.5–9 cm. broad, broadly obtuse to rounded at base, with nearly straight subascending secondaries; British North Borneo and Sarawak .....20. *K. borneensis.*

Pedicels of ♂ flowers 5–6 mm. long at anthesis; leaf-blades somewhat olivaceous in drying, broadly ovate, usually 9.5–11.5 cm. broad, rounded at base, with curved spreading secondaries; Sarawak .....21. *K. Clemensiae.*

1. **Kadsura** (§ *Cosbaea*) **coccinea** (Lem.) comb. nov.

Kadsura japonica sensu Benth. in Hook. Jour. Bot. & Kew Misc. **3:** 258. 1851; non Dunal.

Cosbaea coccinea Lem. in Illustr. Hort. **2:** 71. *fig.* 1855; Baill. in Adansonia **3:** 44. 1862; Morren & de Vos, Ind. Bibl. Hort. Belg. 437. 1887.

Kadsura chinensis Hance ex Benth. Fl. Hongkong. 8 (as "*R.*" *c.*, sphalm.). 1861; Forbes & Hemsl. in Jour. Linn. Soc. Bot. **23:** 25. 1886; Clarke in Jour. Linn. Soc. Bot. **25:**

4. 1889; Harms in E. & P. Nat. Pfl. Nachtr. **1:** 158. 1897; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:** Mém. 4: 54. 1905 [repr. Contr. Fl. As. Or. **2:** 54. 1907]; Dunn & Tutcher in Kew Bull. Add. Ser. **10:** 29. 1912; H. Lév. Fl. Kouy-Tchéou 269. 1914; Rehder in Jour. Arnold Arb. **10:** 190. 1929; Hand.-Maz. Symb. Sin. **7:** 245. 1931; Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1:** 57. 1938; Cheng in Ic. Pl. Omeiens. **1** (*2*)**:** *pl. 73.* 1944; non Turcz. (1837).

Schizandra Hanceana Baill. Hist. Pl. **1:** 150. 1868–69.

Schizandra crassifolia Pierre ex Finet & Gagnep. in Bull. Soc. Bot. Fr. **54:** 85, p. p. 1907, in Lecomte, Fl. Gén. Indo-Chine **1:** 40, p. p. *fig. 8* (*3–5*). 1907.

Kadsura Cavaleriei H. Lév. in Rep. Sp. Nov. **9:** 459. 1911.

Kadsura hainanensis Merr. in Philip. Jour. Sci. Bot. **23:** 240. 1923; Groff, Ding, & Groff in Lingn. Agr. Rev. **1** (*2*)**:** 81. 1923; Merr. in Lingnan Sci. Jour. **5:** 76. 1927; Tanaka & Odashima in Jour. Soc. Trop. Agr. Taihoku **10:** 366. 1938; Masamune, Fl. Kainantensis 82. 1943.

Kadsura Roxburghiana sensu Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1:** 59, p. p. 1938; non Arn.

Kadsura chinensis var. *annamensis* Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1:** 58 (French descr. only). 1938.

Monoecious or apparently often dioecious, glabrous throughout except for rare costal indument on lower surfaces of leaf-blades, the stems often copiously branching distally; young branchlets purpurascent or rarely stramineous, sometimes subflexuose, 1–3.5 mm. in diameter, the older ones becoming cinereous, sparsely lenticellate, up to 10 mm. in diameter; bud-scales several, closely imbricate, papyraceous, orbicular-ovate, ciliolate, up to 3 × 4 mm., early fugacious; leaves 2–9 (–15) per annual shoot, sometimes persisting for more than one growing season; petioles 12–25 (–45) mm. long, 1–2.5 (–4) mm. in diameter; leaf-blades coriaceous, opaque, rarely seen to be copiously but obscurely pellucid-glandular, when dried dark brown or rarely dark olivaceous above, slightly paler beneath, oblong to oblong-lanceolate, ovate-lanceolate, or elliptic, (6–) 8–17 (–22) cm. long, (2–) 2.5–7 (–11.5) cm. broad, obtuse to subacute at base, cuspidate or short-acuminate (apex 3–10 mm. long, obtuse or subacute), entire and narrowly revolute or recurved at margin, rarely furfuraceous on costa proximally beneath with membranaceous ciliolate scales, the costa plane or shallowly impressed above, prominent beneath, the secondary nerves 4–8 per side, subspreading or subascending, slightly curved, inconspicuously raised on both surfaces, anastomosing toward margin, the veinlet-reticulation often immersed, sometimes faintly prominulous above and slightly raised beneath; flowers solitary or rarely paired, axillary or sometimes arising from ultimate shoots below foliage leaves, the subtending bracts few, papyraceous, broadly ovate, ciliolate, up to 1 × 2 mm., early fugacious; ♂ flowers: pedicels rugulose, (5–) 8–30 mm. long and 1–2 mm. in diameter at anthesis, slightly swollen distally, ebracteolate or with 1–3 scattered bracteoles, these papyraceous, suborbicular or oblong-deltoid, ciliolate, 1.4–3 × 1.7–2 mm.; perianth-segments 10–16, the outer ones papyraceous or thin-carnose, obscurely ciliolate, the inner ones increasingly carnose, eciliate, the outermost few broadly deltoid, rounded (smallest 1.5–7 × 3–6 mm.), the largest ones oblong- to obovate-elliptic, 12–25 × 5–14 mm., the innermost few narrowly oblong-obovate, usually 10–20 × 3–8 mm.; androecium with 13–48 free stamens, (5–) 8–19 mm. long including stamens at anthesis, the column 1.5–4 mm. in diameter at base, the distal appendages 3–8 mm. long, usually simple but rarely once-branched, rarely imperfectly fertile, the column rarely not produced distally but completely obscured by stamens; stamens 2–5-seriate, the free filaments carnose, subterete or slightly flattened, 0.5–2 mm. long, sometimes immersed-yellow-glandular distally, the thecae lateral-apical, often slightly extrorse, falcate-ellipsoid, 0.7–1.8 mm. long; ♀ flowers: pedicels as in ♂ but sometimes only 5 mm. long at anthesis; perianth-segments as in ♂; gynoecium ovoid to subglobose, usually 5–6 mm. in diameter

at anthesis, the column ellipsoid to subglobose; carpels 5–7-seriate, 50–80, the ovary ellipsoid to obovoid, often angled by pressure, at anthesis usually 1–1.5 mm. long and 0.7–1.2 mm. broad, the stigmatic crests inconspicuous, densely but minutely glandular-pilose, distally produced into a subulate pseudostyle 0.2–0.7 mm. long, this erect or slightly curved, the proximal appendages none or inconspicuous; fruiting pedicels rugulose, stout, 3–6 mm. in diameter, usually 30–35 mm. long at maturity, often with subpersistent bracteoles, the heads subglobose, often 6–10 cm. (or more?) in diameter, the torus of mature fruits coriaceous, subglobose or ellipsoid, often 20–40 mm. in diameter; mature carpels 50–60 (or more?), obovoid, angled by mutual pressure, up to 40 (–60?) mm. long and 25 mm. broad on the truncate or convex apex, obtuse at base, the pericarp greatly thickened and firmly coriaceous distally, the locule basal; seeds ovoid, 13–18 mm. long, 9–11 mm. broad across the hilar end, gradually narrowed and obtuse at opposite end, the hilar indentation inconspicuous, the testa papyraceous, glossy, brown or stramineous. FIG. 33, f–o.

TYPE LOCALITY: The type of *Cosbaea coccinea* was a specimen cultivated in the botanical garden of Gand, presumably grown from an introduction by Hügel from an unspecified locality.

DISTRIBUTION: Southern China (southern Kiangsi, Hunan, Kweichow, and Szechuan southward, including Hainan) and Indo-China, at recorded altitudes of 450–1750 m. See maps, *figs. 32* and *34*. Various habitats are indicated, including thickets, woods, or forests in ravines or on slopes.

CHINA: "South China," *C. Millett* (K cotype of *K. chinensis* Hance). KIANGSI: Chi-t'an to "Hong San," *J. L. Gressitt 1424* (A, M). HUNAN: Yün Shan, near Wu-kang, *H. v. Handel-Mazzetti 719* (A), *T. H. Wang* (in Handel-Mazzetti) *12126* (K). KWEICHOW: P'ing-fa, *J. Cavalerie 1023* (A. photo. and fragm., K), *3046* (type coll. of *K. Cavalerici*, K); Kweichow?, without locality, *J. Cavalerie 2453* (K). SZECHUAN: O-pien Hsien, *T. T. Yü 850* (A). KWANGTUNG: Lo-ch'ang, *C. L. Tso 20393* (NY), *20740* (NY), *20811* (A, K, NY), *20847* (NY); Yao Shan, North River region, *S. S. Sin 9421* (NY); Ju-yüan Hsien, *S. P. Ko 52560* (A); Fen-shiu Shan, Fen-shiu-au and vicinity, Weng-yüan Hsien, *S. K. Lau 2725* (A); Ah-p'o-kai Shan, Ch'a-p'ing Village, Hsin-feng Hsien, *Y. W. Taam 684* (A); Nam Shan, Ts'ung-shue Village, Ho-yüan Hsien, *W. T. Tsang 28867* (A), *28921* (A); Ying-te Hsien, *Y. K. Wang 2878* (NY); Sam-kok Shan, Ch'an-woh-t'ung Village, Ts'ung-hua Hsien, *W. T. Tsang 25239* (A); Sam-kok Shan, Ts'ung-hua and Lung-men Hsien, *W. T. Tsang 20617* (A, K, M, NY, US); "Naam-kwan" [Nan-k'un] Shan, Sheung-p'ing Village, Lung-men Hsien, *W. T. Tsang 25309* (A). HONGKONG: *C. Wright* (U. S. Expl. Exped. 1853–56) (GH, K, NY, US), *C. Ford* (A, US); below Victoria Peak, *H. F. Hance 601* or *s. n.* (GH, K cotype of *K. chinensis* Hance). HAINAN: Paak-shek Shan, Lin-kao and Ch'eng-mai Hsien, *W. T. Tsang 725* (L. U. 17474) (A, K, M, NY, UC, US); Hung-mo Shan, east of Fan-ta, Loi area, *Y. S. Ip 764* (L. U. 18298) (A, K, NY); near Fan-ya, *F. A. McClure 9524A* (M), *9542* (K, Man type of *K. hainanensis*, UC); Ng-chi Ling, Fan-ya, *N. K. Chun & C. L. Tso 44188* (K, NY, US); Dung-ka, *N. K. Chun & C. L. Tso 43327* (A, NY); Ka-chik Shan and vicinity, Ch'ang-chiang Hsien, *S. K. Lau 1635* (A, NY); Pao-t'ing, *F. C. How 73537* (A); La-k'uei, *F. C. How 72306* (A), Yai-chou, Yai Hsien, *H. Y. Liang 63280* (NY, US); Bak-sa, *S. K. Lau 26664* (A). KWANGSI: Pai-yun-an and vicinity, Ch'üan Hsien, *W. T. Tsang 27711* (A, US); Fu-lung, Sup-man-ta Shan, *H. Y. Liang 69746* (A); Yao Shan, P'ing-nan Hsien, *C. Wang 39219* (A), *39320* (A), *40519* (A); Chu-feng Shan, southwest of Shan-fang, N. Lu-ch'eng, *R. C. Ching 5843* (NY); Pei-lu, Min Shan, N. Lu-ch'eng, *R. C. Ching 5934* (NY); Shap-man-taai Shan, near Iu-shan Village, southeast of Shang-ssu, Kwangtung border, *W. T. Tsang 22311* (A); "Hang-On-Yuen," *T. S. Tsoong* [*Z. S. Chung*] *81750* (A); "Chuen Yuen," *T. T. Tsoong 81933* (A). YÜNNAN: Mountains southeast of Meng-tzu, *A. Henry 10734* (A, K, NY); P'ing-pien Hsien, *H. T. Tsai 55258* (A), *55419* (A), *61266* (A); Ssu-mao, *A. Henry 329* (K), *11810* (K, NY); mountains east of Ssu-mao, *A. Henry 12049* (A, K, NY); without definite locality, *M. K. Li 2339* (A).

INDO-CHINA: TONKIN: Tai Vong Mo Leng, Chan Ùk Village, near Chuc Phai, Ha Coi, *W. T. Tsang 29159* (A); Sai Vong Mo Leng, Lung Wan Village, Dam Ha, *W. T. Tsang 30029* (A); Cha Pa, *A. Pételot 3757* (NY). ANNAM: Mt. Ba Na, southwest of

Tourane, *J. & M. S. Clemens 3768* (A, K, NY, UC, US); Blao, Prov. Haut Dounaï, *E. Poilane 21753* (A), *21755* (A, NY).

LOCAL NAMES and COLOR NOTES: The following names have been recorded: *Chau-fan-tuen-tang, Chau-fan-tuen* (in Kwangtung, by Tsang); *Taai-yeung-kwo-shan-lung, Fan-pau-kwoh* (in Hainan, by Tsang and Ip); *Taai-yeung-chau-fan-tuen, Kwoh-shan-ling-kung* (in Kwangsi, by Tsang); *Re pa, Ro po, Xunh-xe* (in Indo-China, by Gagnepain). Several collectors note that the fruits are sweet and edible.

The perianth-segments are usually recorded as red or pink to purple, magenta, or lavender, but a few collectors state that they are white or yellow proximally, tinged with red or pink distally. Anthesis usually occurs between April and July, but in the south (Kwangsi and Indo-China) there may be another flowering season in December and January. The fruits become red and eventually blackish purple, and mature ones have been noted between August and January.

SYNONYMY: The basonym of my new combination is *Cosbaea coccinea* Lem. (1855), a binomial which has been singularly overlooked or misinterpreted, considering the unmistakable nature of the original description and illustration. The generic name and the binomial were those under which the material had been cultivated before it reached Lemaire; since his was the first publication, it seems advisable to consider Lemaire the author of both genus and species. He remarks that the species flowered for the first time in cultivation at the botanical garden of Gand, where it had been originally received from Daniel, a Viennese horticulturist. Its original source was supposed by Lemaire to have been the collection of "M. le baron de Hügel," and it is quite possible that this traveller obtained his material from the southern coast of China. Lemaire's description and his illustration of a ♂ flower cannot leave the slightest doubt that his plant was identical with the entity so well known in herbaria as *Kadsura chinensis* Hance.

In 1851 Bentham had casually published the identification of a Hongkong plant as *Kadsura japonica,* but by 1861 he had realized his error and in his Flora Hongkongensis he described this plant as *Kadsura chinensis,* attributing the binomial to Hance. Three collections, by Champion, Hance, and Millett, are cited as representing *K. chinensis.* The description, for the most part, applies to the concept covered by *Cosbaea coccinea.* That the specimens referred to *K. chinensis* are not conspecific was first pointed out by Clarke, who in 1889 removed the Champion specimen to make it the type of his new *Kadsura Championi* (*K. heteroclita* in the present treatment). The two specimens remaining in *K. chinensis* Hance ex Benth., collected by Hance and Millett, may be considered cotypes and are so cited above.

Even if it were not a synonym of *Cosbaea coccinea, Kadsura chinensis* Hance ex Benth. could not be accepted as the valid name for this species because of the earlier *Kadsura chinensis* Turcz. (1837), the basonym of *Schisandra chinensis* (Turcz.) Baill.

Baillon, in 1868–69, pointed out the identity of *Cosbaea coccinea* and *Kadsura chinensis* Hance. Since Baillon merged the genera *Kadsura* and *Schisandra,* to find a binomial in the latter genus for this plant presented a dilemma. He could not use Lemaire's epithet because of *Schisandra coccinea* Michx. (1803), nor Hance's because of the combination *S. chinensis* (Turcz.) Baill. proposed by him in the same paper. Therefore he coined the binomial *Schizandra Hanceana;* this is to be construed as a direct re-naming of *Cosbaea coccinea.*

Schizandra crassifolia Pierre appears to be a mixture; I believe that the pistillate element represents the present concept, while the staminate element represents *K. heteroclita,* under which the binomial is also cited by me.

Kadsura Cavaleriei H. Lév. is typified by *Cavalerie 3046,* from Kweichow, cited above. This specimen is entirely typical of the entity described above, a fact which Léveillé himself realized when, in 1914, he reduced his own species to *K. chinensis* Hance.

Kadsura hainanensis Merr. is typified by *McClure 9542,* cited above. This specimen and numerous other collections from Hainan appear to me essentially identical with material of this group from the mainland. The organs described by Merrill as styles are actually androecial appendages, the variable development of which is a characteristic of § *Cosbaea.*

In 1938 Gagnepain cited two specimens as representing *K. Roxburghiana,* of which at least one (*Clemens,* from Mt. Ba Na) belongs to *K. coccinea.* I have not seen the other cited specimen, a collection by Eberhardt from Tonkin.

Kadsura chinensis var. *annamensis* was described in 1938 by Gagnepain in French only, and as far as I can ascertain this trinomial has never been validated by a Latin diagnosis. It is based on a collection of Poilane from Blao, Annam, and Gagnepain intimates that it differs from typical material of *K. chinensis* in its narrower leaves, partially white flowers,

elongated pedicels, obvious filaments, and lack of free androecial appendages. In view of the normal variation in *K. coccinea*, these characters are hardly noteworthy.

The characters which so sharply distinguish § *Cosbaea* from the remaining sections of *Kadsura* have been discussed above, following the generic description. Among the specimens which I cite as *K. coccinea* there is a great deal of androecial variation, the column varying from an inconspicuous rounded cushion to an elongate cone which may or may not terminate in an indefinite number of slender appendages. The extremes of this variation may appear, at first glance, worthy of nomenclatural recognition, but actually every intermediate stage may be found,

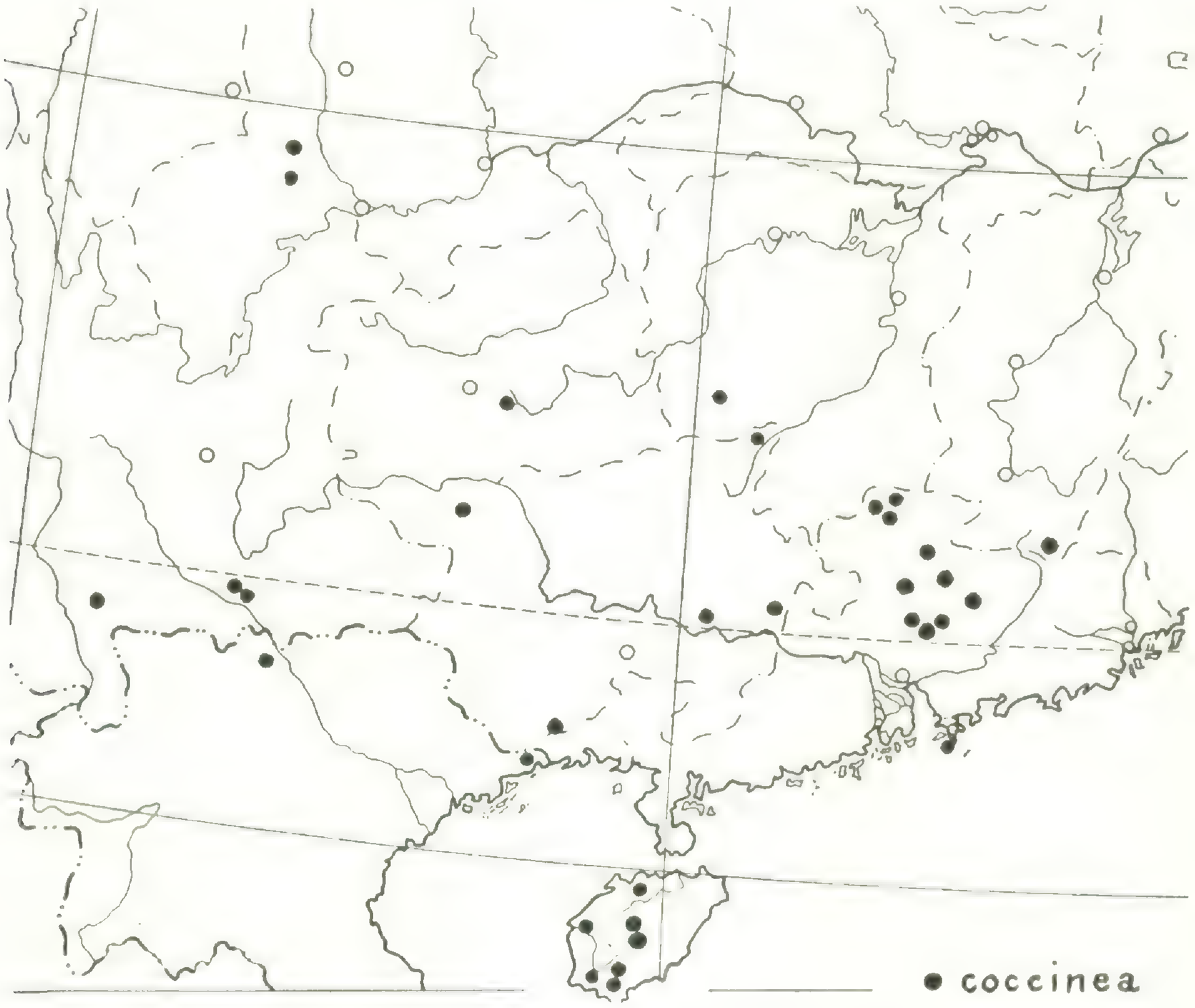

FIG. 32. Approximate known distribution of *Kadsura coccinea* in China and northern Indo-China. For further distribution southward in Indo-China see *fig. 34.*

and often the same plant shows nearly the entire scope of variability. It seems, therefore, that the shape of the column is very plastic in the ♂ flowers of § *Cosbaea,* although the fundamental androecial characters are reasonably stable.

Foliage variation is probably not unusual for a species of *Kadsura.* Throughout most of the range the leaves are very uniform in texture, with immersed venation, but toward the south the veins and veinlets are often more obvious beneath and sometimes on both surfaces. However, the smooth-leaved form may be found throughout the range of the species. The occasional presence of ciliolate scales on the costa should be noted; such scales have been observed in *Yü 850* (Szechuan), *Wang 39219* (Kwangsi), and *Henry 10734* and *11810* (Yünnan).

A similar furfuraceous indument is also found in *K. ananosma,* where other distinguishing characters accompany it.

The Indo-Chinese specimens appear typical for *K. coccinea,* but in Siam and southern Burma the species is replaced by *K. ananosma* and *K. calophylla.* Although these two are not very strongly marked species, each being represented by only a single known collection, the characters brought out in my key seem amply to distinguish them from *K. coccinea,* at least unless more abundant material should provide transitional forms.

2. **Kadsura** (§ *Cosbaea*) **ananosma** Kerr in Kew Bull. **1936:** 34. 1936.

Apparently dioecious, glabrous throughout except for frequent costal indument on lower surfaces of leaf-blades; younger branchlets brownish, 2–3 mm. in diameter, the older ones often cinereous, up to 5 mm. in diameter; bud-scales apparently several but fugacious; leaves 3–7 per annual shoot; petioles 15–22 mm. long, 1.5–2 mm. in diameter; leaf-blades papyraceous or chartaceous, copiously and obviously pellucid-glandular, when dried dark olivaceous above and pale brown beneath, elliptic, (8–) 10–17.5 cm. long, 4–8 cm. broad, obtuse at base, cuspidate (apex 3–5 mm. long, obtuse), entire and narrowly recurved at margin, the costa slightly impressed above, prominent beneath and often copiously furfuraceous proximally with crowded membranaceous ciliolate scales, these attached by the broad bases in close parallel longitudinal rows, the secondary nerves 8–10 per side, subspreading, slightly raised above and obviously raised beneath, anastomosing toward margin, the veinlet-reticulation prominulous on both surfaces; flowers solitary, axillary or arising from ultimate shoots below leaves, the subtending bracts early fugacious; ♂ flowers essentially as in *K. coccinea;* pedicels 15–22 mm. long at anthesis; perianth-segments usually 14–16, the largest ones oblong or obovate-oblong, up to 25 × 8 mm.; androecium about 18 mm. long, the column distally produced into 10–15 subulate appendages 6–8 mm. long; stamens 60–70, about 6-seriate, the filaments 1.5–2 mm. long; ♀ flowers and fruits not seen. FIG. 33, a–e.

TYPE LOCALITY: Doi Ang Ka, Siam; type, *Garrett 940.*

DISTRIBUTION: Known only from the type collection, from northwestern Siam at 1460 m. altitude. See map, *fig. 34.*

SIAM: PAYAP: Doi Ang Ka (Doi Inthanon), Thanon Thong Chai Range, west-southwest of Chiang Mai, *H. B. G. Garrett 940* (A, K TYPE).

COLOR NOTES: The collector notes the perianth-segments as yellow-green, tipped with red; the type was collected with mature flowers in April, 1935. The plant was said to smell of pineapples; hence the specific epithet.

Although *K. ananosma* is perhaps no more than an extreme variant of *K. coccinea,* I am inclined to agree with Kerr that it is sufficiently distinct to merit specific status. Fairly consistent differences, as noted in my key to species, pertain to the much thinner leaf-blades of the Siamese species with the concomitantly obvious pellucid glands and veinlet-reticulation, the more numerous secondary nerves, and the more numerous stamens. The costal indument, usually present on the leaves of *K. ananosma,* is rare in *K. coccinea.* The ♂ flowers offer no differentiating characters, as those of *K. ananosma* fall within the normal variation to be expected in *K. coccinea* in all characters except the more numerous stamens, and even here a certain degree of variation is to be anticipated.

3. **Kadsura** (§ *Cosbaea*) **calophylla** sp. nov.

Planta monoica ubique glabra, ramulis hornotinis brunneis 2.5–5 mm. diametro, vetustioribus cinerascentibus inconspicue lenticellatis; squamis basi ramulorum hornotinorum ut videtur paucis fugacibus; foliis 3–7 per ramulum hornotinum,

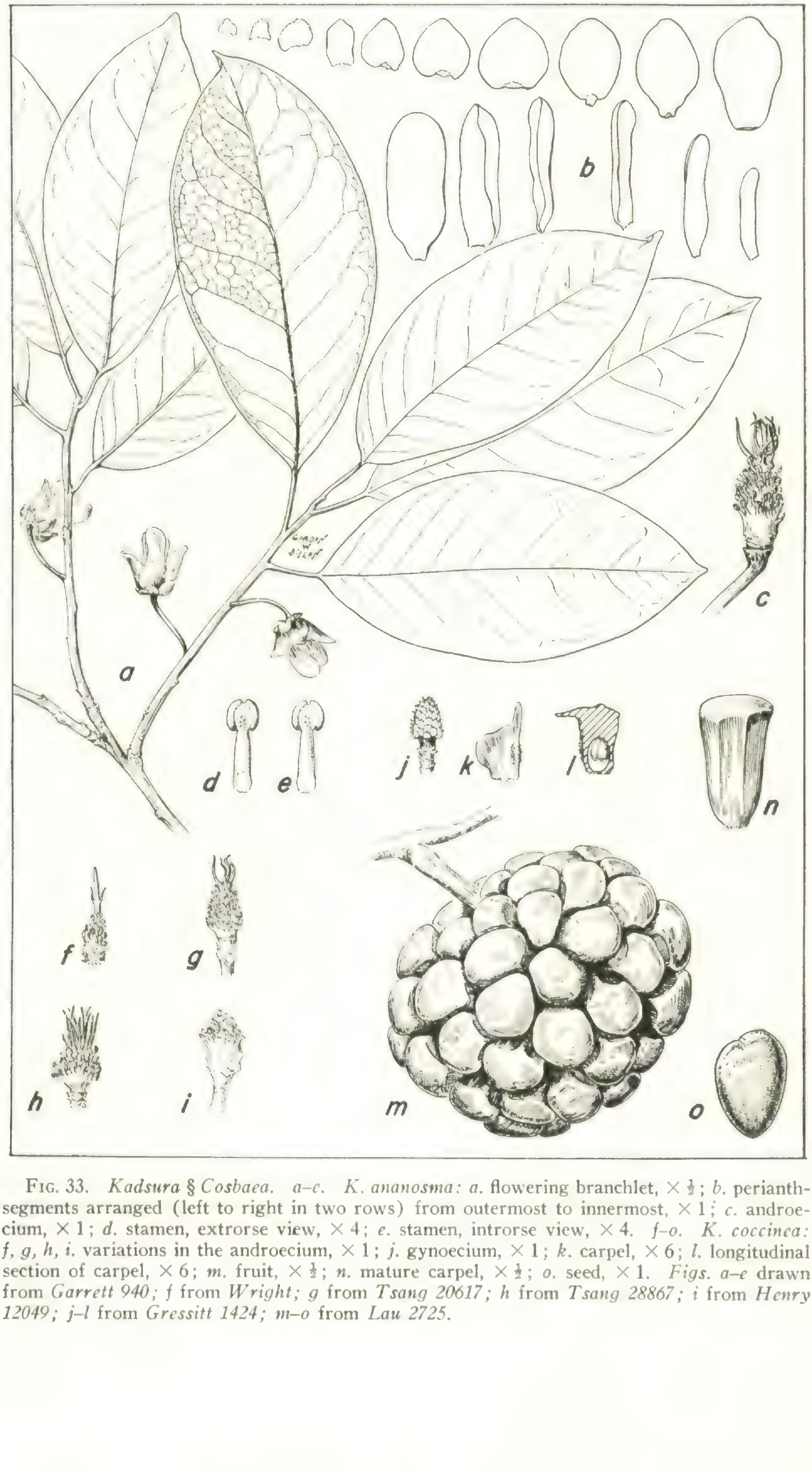

FIG. 33. *Kadsura* § *Cosbaea*. *a–e*. *K. ananosma*: *a*. flowering branchlet, × ½; *b*. perianth-segments arranged (left to right in two rows) from outermost to innermost, × 1; *c*. androecium, × 1; *d*. stamen, extrorse view, × 4; *e*. stamen, introrse view, × 4. *f–o*. *K. coccinea*: *f, g, h, i*. variations in the androecium, × 1; *j*. gynoecium, × 1; *k*. carpel, × 6; *l*. longitudinal section of carpel, × 6; *m*. fruit, × ½; *n*. mature carpel, × ½; *o*. seed, × 1. *Figs. a–e* drawn from *Garrett 940*; *f* from *Wright*; *g* from *Tsang 20617*; *h* from *Tsang 28867*; *i* from *Henry 12049*; *j–l* from *Gressitt 1424*; *m–o* from *Lau 2725*.

petiolis 30–40 mm. longis circiter 2 mm. diametro; laminis papyraceis copiose pellucido-glandulosis in sicco utrinque olivaceo-viridibus, late ovatis, (8–) 11–13.5 cm. longis, (5–) 7–10.5 cm. latis, basi rotundatis vel late obtusis et subito breviterque in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, margine integris et inconspicue calloso-recurvatis, costa supra subplana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 7–9 supra subplanis subtus elevatis basalibus congestis e costa patentibus superioribus curvato-adscendentibus, rete venularum intricato utrinque plus minusve prominulo; floribus solitariis e ramulis infra folia orientibus vel in ramulis lateralibus brevibus subcongestis, bracteis basalibus fugacibus; floribus ♂ ut eis *K. coccineae* subsimilibus; pedicellis sub anthesi 30–40 mm. longis 1.5–2 mm. diametro apice incrassatis, bracteola nulla vel unica circiter 3 × 2 mm.; segmentis perianthii circiter 12, maximis anguste oblongo-ellipticis 20–23 × 9–11 mm.; androecio circiter 15 mm. longo, columna basi circiter 3 mm. diametro apice in appendiculis 2 vel 3 subulatis producta; staminibus circiter 45 plerumque 5- vel 6-seriatis, filamentis circiter 2 mm. longis obscure glandulosis, thecis 1–1.3 mm. longis subintrorse dehiscentibus; floribus ♀: pedicellis et perianthio ut ♂; gynoecio ut eo *K. coccineae,* carpellis circiter 50; fructibus non visis.

TYPE LOCALITY: Tenasserim, Burma; type, *Parkinson 5123.*

DISTRIBUTION: Known only from the type collection, from southern Burma at about 1350 m. altitude. See map, *fig. 34.*

BURMA: TENASSERIM: Slopes of Mulai-yit Hill, Dawna Range, Amherst District, *C. E. Parkinson 5123* (K TYPE), Feb. 2, 1927.

COLOR NOTES: The collector states that the perianth-segments are white, with pink tips; mature flowers accompany the type.

The collection described above appears specifically distinct from its two allies in § *Cosbaea,* although of course both the new species and *K. ananosma,* being known from single collections, may demonstrate considerably more variation as they become better known. On the basis of available material, *K. calophylla* may be distinguished by its broadly ovate round-based leaf-blades, which in texture approximate those of *K. ananosma.* As pointed out in my key to species, characters pertaining to the venation, the length of pedicels, and the number of stamens separate these two species. The stamens of *K. calophylla* have thecae which appear to be somewhat introrse in dehiscence, while those of its allies are either strictly lateral or somewhat extrorse; whether or not this character is dependable in this group remains to be seen.

4. **Kadsura** (§ *Eukadsura*) **induta** sp. nov.

Planta ut videtur dioica, ramulis validis, hornotinis 1.5–5 mm. diametro tomento subtomentello copiose indutis (pilis spadiceis simplicibus 3–7-cellularibus 0.2–0.3 mm. longis), annotinis ad 8 mm. diametro obvie lenticellatis demum subglabrescentibus; cicatricibus squamarum ramulos subtendentium pluribus; foliis 5–10 per ramulum hornotinum, petiolis ut ramulis pubescentibus leviter canaliculatis 12–20 mm. longis 1–1.5 mm. diametro; laminis chartaceis in sicco supra fusco-brunneis subtus paullo pallidioribus, ovato-ellipticis, 9–13 cm. longis, 4.5–6.5 cm. latis, basi obtusis vel subrotundatis et in petiolum breviter decurrentibus, apice in acuminem 5–12 mm. longum subacutum angustatis, margine inconspicue denticulatis (dentibus 1 vel 2 per centimetrum calloso-apiculatis), supra glabris subnitidisque, subtus tomento ei ramulorum simili (pilis 5–12-cellularibus 0.3–0.4 mm. longis) praecipue costa secundariisque denso copiose indutis, costa supra acute impressa subtus prominente, nervis secundariis utrinsecus 8–13 subpatentibus leviter curvatis copiose anastomosantibus supra prominulis subtus elevatis, rete venularum intricato utrinque prominulo; floribus axillaribus solitariis, bracteis basalibus paucis papyraceis deltoideis obtusis ad 1 × 2 mm. extus obscure

puberulis; floribus ♂: pedicellis sub anthesi 12–17 mm. longis 1–1.2 mm. diametro copiose crispato-pilosis, bracteolis plerumque 3 vel 4 submembranaceis ovato-deltoideis 1.5–2 mm. longis latisque extus puberulis; segmentis perianthii 17–19 papyraceis vel submembranaceis, omnino minute pellucido-glandulosis extus copiose minute puberulis intus glabris margine obscure ciliolatis, extimis 2 vel 3 ovato-deltoideis obtusis 3–4 × 3–4 mm., maximis oblongo-ellipticis 11–13 × 6–8 mm., intimis 4 vel 5 ad 5–7 × 4–5 mm. reductis; androecio ovoideo-ellipsoideo sub anthesi 5–6 × 4.5–5 mm., staminibus 10- vel 11-seriatis 73–80, antheris toro carnoso

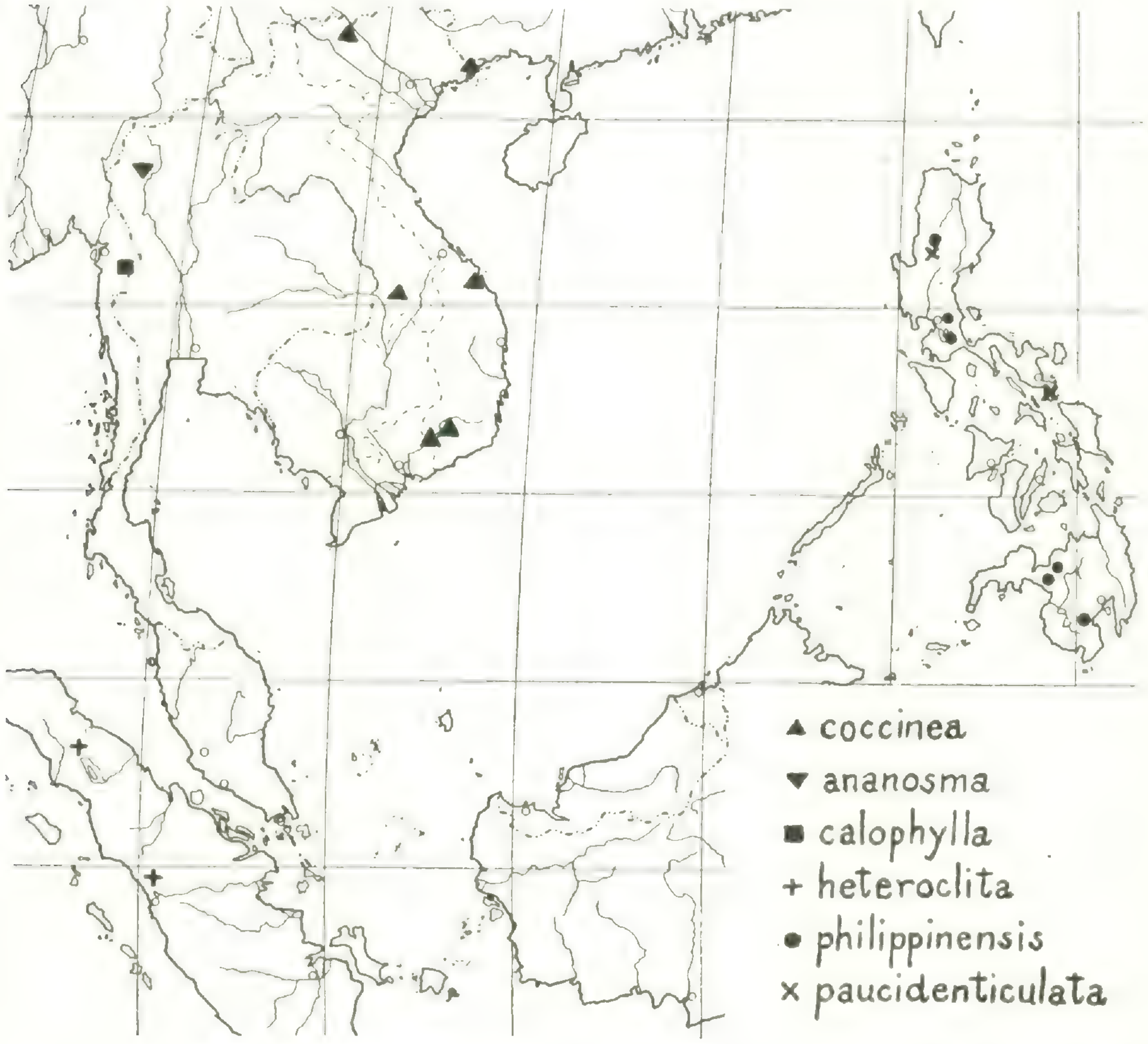

FIG. 34. Approximate known distribution of *K. coccinea* (in Indo-China only; see also *fig. 32*), *K. ananosma, K. calophylla, K. heteroclita* (Sumatran specimens only; see also *figs. 38* and *39*), *K. philippinensis,* and *K. paucidenticulata.*

subsessilibus circiter 1 mm. longis, connectivo transverse oblongo-ellipsoideo, 1.3–1.8 mm. lato, 0.4–0.6 mm. crasso, apice complanato et obscure immerso-glanduloso, thecis lateralibus ellipsoideis 0.5–0.7 mm. longis; floribus ♀ fructibusque non visis.

TYPE LOCALITY: P'ing-pien Hsien, southeastern Yünnan; *Tsai 60946,* the better of the cited specimens, is designated as the type.

DISTRIBUTION: Known only from the type locality, in ravines at 1300–1500 m. altitude. See map, *fig. 35.*

CHINA: YÜNNAN: P'ing-pien Hsien, *H. T. Tsai 60847* (A), *60946* (A TYPE), July 18, 1934.

The apparently rare and local entity described above is extraordinarily distinct, in a genus where clear-cut specific characters are the exception. *Kadsura induta* is the most readily recognized species of § *Eukadsura,* differing from all others of the section in the characteristic tomentum of simple several-celled hairs; furthermore the stamens are very numerous for § *Eukadsura.* The two known collections come from Tsai's remarkable locality P'ing-pien Hsien; under *Schisandra micrantha* I have already discussed this significant region. Both collections were flowering in July, but no color notes are given.

FIG. 35. Approximate known distribution of *Kadsura induta, K. oblongifolia, K. angustifolia,* and *K. interior.*

5. **Kadsura** (§ *Eukadsura*) **oblongifolia** Merr. in Philip. Jour. Sci. Bot. **23:** 241. 1923; Groff, Ding, & Groff in Lingn. Agr. Rev. **1** (2): 81. 1923; Merr. in Lingnan Sci. Jour. **5:** 76. 1927; Tanaka & Odashima in Jour. Soc. Trop. Agr. Taihoku **10:** 366. 1938; Masamune, Fl. Kainantensis 82. 1943.

Kadsura japonica sensu Matsuda in Bot. Mag. Tokyo **31:** (181). 1917; non Dunal.

Monoecious or sometimes appearing dioecious, glabrous throughout, the branchlets slender, elongate, the young ones brownish or purpurascent, 1–2 mm. in diameter, the older ones often cinerascent, up to 4 mm. in diameter; bud-scales several, papyraceous, deltoid, obtuse, up to 3 × 3 mm., caducous; leaves 4–15

per annual shoot, occasionally persisting for more than one growing season; petioles often narrowly winged nearly to base, 5–12 mm. long, slender, 0.8–1.2 mm. in diameter; leaf-blades papyraceous, obscurely pellucid-glandular when very young, when dried dark olivaceous or brownish above and slightly paler beneath, lanceolate-oblong or narrowly elliptic, (4–) 6–10 cm. long, (1–) 1.5–3.8 (–4.7) cm. broad, obtuse or acute at base, obtuse or obtusely cuspidate at apex, entire and narrowly recurved at margin or remotely and inconspicuously denticulate with blunt callose teeth, the costa subplane or shallowly impressed above, raised beneath, the secondary nerves 4–8 per side, ascending, slightly curved, slightly raised on both surfaces, obviously anastomosing toward margin, the veinlet-reticulation intricate, prominulous on both surfaces; flowers axillary, solitary, the subtending bracts few, subpersistent, papyraceous, broadly deltoid, about 1 × 2 mm.; ♂ flowers: pedicels at anthesis 10–15 mm. long, very slender, usually less than 0.5 mm. in diameter, with about 3 bracteoles, these submembranaceous, ovate-deltoid, fimbriolate-erosulous, about 1 × 1 mm.; perianth-segments 12 or 13, submembranaceous, obscurely yellow-punctate, the outer ones obscurely ciliolate, the outermost 2 or 3 deltoid, obtuse, 1–2.5 mm. long and broad, the largest ones elliptic to obovate-oblong, 5–8 × 3.5–5.5 mm., the innermost few slightly reduced; androecium subglobose, 4–5 mm. in diameter, at anthesis, the stamens 4- or 5-seriate, about 25, the free filaments essentially none, the connective yellow-glandular, 1–2.5 mm. broad, 0.5–1 mm. thick, the thecae obliquely lateral, 0.6–0.8 mm. long; ♀ flowers: pedicel as in ♂ but sometimes up to 30 mm. long at anthesis; perianth-segments as in ♂; gynoecium subglobose, at anthesis usually 4–4.5 mm. in diameter, short-stipitate; carpels 4- or 5-seriate, 35–50, the ovary obovoid, at anthesis 1.5–1.8 × 1–1.5 mm., broadest across the slightly convex summit, the stigmatic crests inconspicuous, terminated by a peltate pseudostigma about 0.3 mm. in diameter, the ovary-wall uniform in thickness, the ovules 2 or 3; fruiting pedicels at maturity 20–35 (rarely to 60) mm. long, remaining slender, up to 1 mm. in diameter, the heads subglobose or ellipsoid, at apparent maturity 1.2–2 cm. in diameter, the torus coriaceous, oblong-ellipsoid, about 7–15 × 4–5 mm.; mature carpels usually 25–50, subglobose to ellipsoid or obovoid, 5–7 × 4–5 mm., the pericarp thin-carnose, fairly uniform in thickness, often showing shape of seeds when dried; seeds 2 or 3, subglobose-flattened, slightly reniform or ellipsoid, 4–4.5 mm. long, 3–3.7 mm. broad, the hilar indentation slight, on long axis, the testa brown. FIG. 36, a–e.

TYPE LOCALITY: Na-ta, Hainan; type, *McClure 1668* (*8011*), cited below.

DISTRIBUTION: Endemic to Hainan, at recorded altitudes of 250–1000 m., usually in thickets. See map, *fig. 35*.

CHINA: HAINAN: Tai-wong Ling and vicinity, Tung-pin-tin Village, Ch'eng-mai Hsien, *C. I. Lei 205* (A, K, NY, UC, US); Taai Hang, Lin-fa Shan, Lin-kao Hsien, *W. T. Tsang 357* (L. U. 15856) (A, K, NY, UC, US); Na-ta [Nodoa], *F. A. McClure 1668* (C. C. C. 8011) (M, Man TYPE, UC), *W. Y. Chun 5719* (UC); Ng-chi Ling, Fan-ya, *N. K. Chun & C. L. Tso 44132* (A, NY); Pao-t'ing, *S. K. Lau 28016* (A); "Nor-tai-see," Comm. C. Ford 441 (K, NY).

LOCAL NAMES and COLOR NOTES: *Fan-tuen-tang* and *Lan-fan-t'ang* have been recorded by Lei and Tsang respectively. The perianth-segments are reported as either red or yellow (probably becoming red at maturity), and mature flowers are found in October and November. The available fruits are said to be reddish green and have been collected in October.

SYNONYMY: Matsuda's reference of Hainan plants to *K. japonica* is included in my synonymy on the authority of Masamune (in 1943).

This endemic Hainan species is fairly distinct on the basis of its slender habit, narrow leaf-blades, comparatively few stamens, and small fruiting heads. As Merrill points out in the original discussion, it is closely allied to *K. japonica*. It can hardly be confused with *K. heteroclita*, the only other species of § *Eukadsura* known to occur on Hainan.

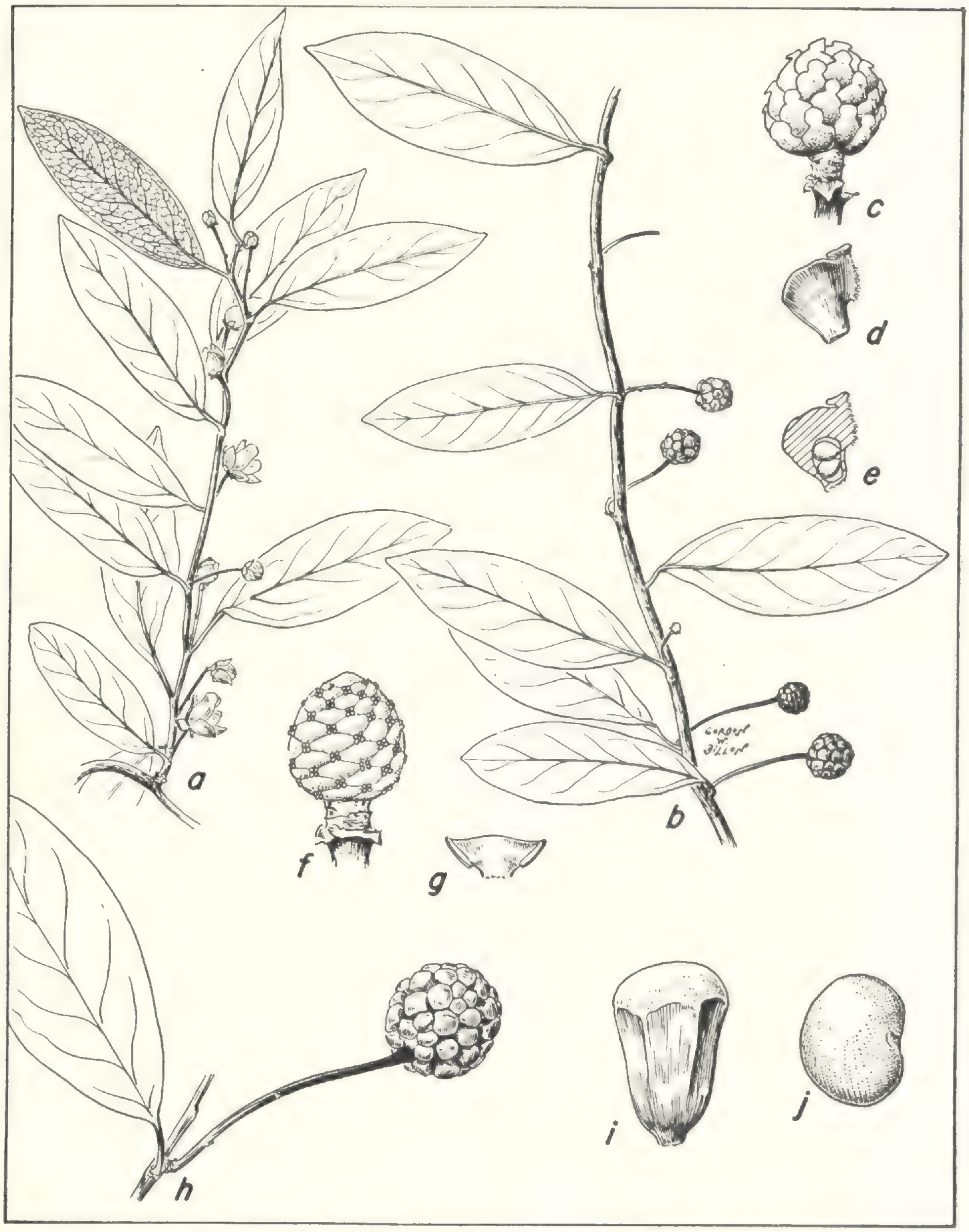

FIG. 36. *Kadsura* § *Eukadsura*. *a–e*. *K. oblongifolia:* *a*. ♀ flowering branchlet, × ½; *b*. fruiting branchlet, × ½; *c*. gynoecium, × 3; *d*. carpel, × 5; *e*. longitudinal section of carpel, × 5. *f–j*. *K. longepedunculata:* *f*. androecium, × 3; *g*. stamen, lateral view, × 6; *h*. fruit, × ½; *i*. mature carpel, × 2; *j*. seed, × 3. *Figs. a–e* drawn from Comm. Ford 441; *f, g* from *Wilson 1736; h–j* from *Ching 2570.*

6. **Kadsura** (§ *Eukadsura*) **angustifolia** sp. nov.

Kadsura oblongifolia sensu Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1**: 58. 1938; non Merr.

Planta ut videtur dioica, ramulis fusco-brunneis elongatis, hornotinis striato-rugulosis vel leviter angulatis 1–4 mm. diametro, annotinis subteretibus ad 6 mm.

diametro; squamis basi ramulorum hornotinorum paucis papyraceis subdeltoideis ad 1.5 mm. longis fugacibus; foliis 5–20 per ramulum hornotinum, petiolis profunde canaliculatis 10–13 mm. longis gracilibus 0.5–1 mm. diametro; laminis papyraceis in sicco brunneis vel fusco-olivaceis, lanceolatis, 7–11 cm. longis, 2.3–3.5 cm. latis, basi subacutis, apice in acuminem 5–10 mm. longum obtusum gradatim angustatis, margine distaliter inconspicue denticulatis (dentibus 2 vel 3 per centimetrum calloso-apiculatis), costa supra impressa subtus prominente, nervis secundariis principalibus utrinsecus 8–12 erecto-patentibus leviter curvatis supra haud prominulis subtus paullo elevatis, rete venularum inconspicuo supra immerso subtus subprominulo; floribus axillaribus solitariis, bracteis basalibus minutis fugacibus; floribus ♀ solis visis: pedicellis sub anthesi 10–18 mm. longis circiter 1.2 mm. diametro, bracteolis 2 vel 3 papyraceis deltoideis subacutis obscure ciliolatis circiter 2 × 1.7 mm.; segmentis perianthii circiter 15 interdum obscure ciliolatis, exterioribus papyraceis obscure glandulosis, interioribus carnosis eglandulosis, extimis paucis late deltoideis obtusis 2–3 × 2.5–4.5 mm., maximis ellipticis 8–9 × 6–7 mm., interioribus 8 gradatim reductis elliptico-obovatis intimis 3.5–5 × 2.5–3.5 mm.; gynoecio ellipsoideo sub anthesi circiter 4.5 × 4 mm.; carpellis 5–7-seriatis 75–80, ovario oblongo-ellipsoideo quadrangulato carnoso sub anthesi circiter 1 × 0.5–0.7 mm., basi leviter angustato, apice complanato, cristis stigmatiferis obviis in pseudostigma minutum peltatum circiter 0.15 mm. diametro distaliter productis, loculo subcentrali, ovulis 2.

TYPE LOCALITY: Vicinity of Cha Pa, Tonkin; type, *Poilane 12624*.

DISTRIBUTION: Known only from the type collection, from northern Indo-China in deep forest at about 1800 m. altitude. See map, *fig. 35*.

INDO-CHINA: TONKIN: Col de Lô-qui-Hô, near Cha Pa, *E. Poilane 12624* (A TYPE), July 28, 1926.

SYNONYMY: Gagnepain in 1938 cited a specimen (*Poilane s. n.*) from the above locality as representing *K. oblongifolia*, and I feel sure that he had no. *12624* at hand.

Although the specimen described above superficially suggests *K. oblongifolia*, the Hainan endemic, it clearly differs in the more numerous lateral nerves of its leaf-blades, the more numerous perianth-segments, which are comparatively carnose and more sharply reduced in size inward, and in having the carpels 75–80 rather than 35–50 in number. In the numerous carpels and in details of foliage *K. angustifolia* differs from such other species of § *Eukadsura* as *K. heteroclita*, which also occurs in Indo-China. The Poilane specimen bore mature flowers in July, but no color notes are given.

7. **Kadsura** (§ *Eukadsura*) **interior** sp. nov.

Kadsura heteroclita sensu Merr. in Brittonia **4**: 52. 1941; non Craib.

Planta monoica vel interdum ut videtur dioica ubique glabra, ramulis brunneis vel stramineis, juventute 1.5–3 mm. diametro, vetustioribus ad 7 mm. diametro; squamis basi ramulorum hornotinorum pluribus subcoriaceis late deltoideis obtusis ad 2 × 3 mm. fugacibus; foliis 5–15 per ramulum hornotinum interdum subpersistentibus; petiolis 8–18 mm. longis 1–1.5 mm. diametro; laminis chartaceis vel subcoriaceis in sicco fusco-olivaceis vel fusco-viridibus concoloribus, ellipticis, 7–12.5 cm. longis, 3–6.2 cm. latis, basi obtusis, apice in acuminem 3–10 mm. longum obtusum cuspidatis vel breviter acuminatis, margine subintegris vel denticulatis (dentibus circiter 2 per centimetrum calloso-apiculatis), costa supra impressa vel subplana subtus prominente, nervis secundariis utrinsecus 7–10 subpatentibus paullo curvatis utrinque leviter elevatis vel supra subplanis, rete venularum intricato utrinque paullo prominulo vel subimmerso; floribus axillaribus et solitariis vel in ramulis brevibus lateralibus 2–4 congestis, bracteis basalibus paucis papyraceis deltoideis circiter 1 mm. longis fugacibus; floribus ♂: pedicellis sub anthesi 7–15 mm. longis, 1.5–2 mm. diametro superne incrassatis, bracteolis

nullis vel mox caducis; segmentis perianthii 14–18, exterioribus papyraceis vel submembranaceis pellucido-glandulosis ciliolatis, interioribus carnosis eciliatis, extimis 2 vel 3 ovato-ellipticis 5–10 × 4–7 mm., maximis elliptico-oblongis vel obovatis 13–19 × 8–11 mm., intimis ad 10 × 5 mm. reductis; androecio subgloboso sub anthesi 6.5–9 mm. diametro, staminibus 7- vel 8-seriatis circiter 60, inferioribus breviter stipitatis, filamentis liberis carnosis 0.8–1.5 mm. longis superne in connectivum gradatim incrassatis, connectivo transverse ellipsoideo, 1.5–2.5 mm. latis, circiter 1 mm. crasso, apice complanato, thecis plerumque 0.6–1 mm. longis; floribus ♀: pedicellis ut ♂ sed interdum ad 40 mm. longis; segmentis perianthii ut videtur 10 vel 11 ut ♂, maximis 15–23 × 11–12 mm.; gynoecio ovoideo-subgloboso sub anthesi 8–12 mm. diametro; carpellis 60–75, ovario oblongo-obovoideo sub anthesi 2–3 × 1.5–2 mm., cristis stigmatiferis membranaceis ciliolatis in pseudostigma peltatum circiter 0.8 mm. diametro distaliter productis, loculo subbasali, ovulis 3–5 ventralibus; pedicellis sub fructu validis ad 3 mm. diametro 15–40 mm. longis, capitulis subglobosis immaturis ad 3 cm. diametro [maturis 10 cm. diametro ex Ward], carpellis circiter 60 (vel ultra?) obovoideis, immaturis ad 15 mm. longis et apice convexo 10 mm. latis [ad 25 mm. longis ex Ward], pericarpio in sicco coriaceo superne valde incrassato, seminibus (maturis non visis) subbasalibus.

TYPE LOCALITY: Shun-ning, Yünnan; *Yü 16138,* a monoecious specimen with the best available flowers, is designated as the type.

DISTRIBUTION: Yünnan and northern Burma, at altitudes between 1200 and 2500 m. See map, *fig. 35.* Mentioned as habitats are woods, forest, jungle, and bamboo thickets.

CHINA: YÜNNAN: "Kiukiang Valley" north of Mou-ting, *T. T. Yü 20542* (A); Shunning, "Tehloching," *T. T. Yü 16138* (A TYPE), June 5, 1938; Keng-ma, "Chuichayko," *T. T. Yü 17320* (A).

BURMA: SAGAING: Myitkyina: Nam Tamai, Adung–Seinghku confluence, *F. K. Ward 9173* (A); Adung Valley, *F. K. Ward 9460* (A).

COLOR NOTES: The perianth-segments are pale to creamy yellow, although apparently the inner ones may shade into pinkish red; Ward notes the androecium as crimson and the gynoecium as having white or colorless "stigmas." Mature flowers have been obtained in May and June, but Yü also collected buds in October (no. *20542*). Ward notes the mature fruits as bright red in January; younger fruits were obtained by Yü in August (no. *17320*).

SYNONYMY: The cited Ward specimens were mentioned as representing *K. heteroclita* by Merrill in 1941.

Although it is indubitably closely allied to *K. heteroclita,* the new species differs from that widespread entity in its large perianth-segments (of which the outermost are definitely not reduced and bracteole-like) and its more numerous carpels. It should be noted that the range of the new species, comparatively limited, is peripheral to that of *K. heteroclita.*

8. **Kadsura** (§ *Eukadsura*) **japonica** (L.) Dunal, Monogr. Anon. 57. 1817; DC. Reg. Veg. Syst. Nat. **1:** 466. 1817, Prodr. **1:** 83. 1824; Sieb. in Verh. Batav. Gen. **12:** 50. 1830; G. Don, Gen. Syst. **1:** 102. 1831; Sieb. & Zucc. Fl. Jap. **1:** 40. *tab. 17.* 1836; Loudon, Arb. et Frut. Brit. **1:** 295. 1838; Spach, Hist. Nat. Veg. **8:** 9. 1839; Walp. Rep. Bot. Syst. **1:** 92. 1842; Dietr. Syn. Pl. **3:** 307. 1843; Schnizl. Iconogr. **3:** *pl. 175, fig. 1–17.* 1843–70; Hassk. Cat. Pl. Hort. Bot. Bog. 177. 1844; Sieb. & Zucc. in Abh. Bayer. Akad. Wiss. Math. Phys. Cl. **4** (*2*): 188. 1845 [Fl. Jap. Fam. Nat. **1:** 80]; Walp. Rep. Bot. Syst. **2:** 15. 1845; Baill. in Adansonia **3:** 42–44. 1862; K. Koch, Dendr. **1:** 387. 1869; Franch. & Sav. Enum. Pl. Jap. **1:** 18. 1873; Hemsl. in Garden **8:** 271. 1875; Laval. Arbor. Segrez. 9. 1877; Lauche, Deutsche Dendrol. 362. *fig. 141.* 1880; Nichols. Ill. Dict. Gard. **2:** 214. 1885; Prantl in E. & P. Nat. Pfl. III. **2:** 18. 1888; Tanaka, [Illustr. Useful Pl.] *fig. 403.* 1891; Dippel, Handb. Laubholzk. **3:** 157. 1893; Koehne, Deutsche Dendr. 149. *fig. 28, J–R.* 1893; Tanaka, Useful Pl. Jap. 109. 1895; Parment. in Bull. Sci. Fr. & Belg. **27:** 237, 313. *pl. 8, fig. 9.* 1896; Ito & Matsum. in Jour. Coll. Sci. Tokyo **12:** 285. 1900; Bailey, Cycl. Am. Hort. **2:** 852. 1900; Beissn., Schelle, & Zabel, Handb. Laubh.-Benen. 102. 1903; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52:**

Mém. 4: 53. 1905 [repr. Contr. Fl. As. Or. 2: 53. 1907]; Schneid. Ill. Handb. Laubholzk. 1: 341. *fig. 218, c, 219, k–u.* 1905; Hayata in Jour. Coll. Sci. Tokyo **25:** 45. 1908; Tokubuchi in Miyabe-Festschr. 321. 1911; Matsum. Ind. Pl. Jap. 2 (2): 93. 1912; Silva Tarouca, Freil.-Laubgeh. 244. 1913; Bean, Trees and Shrubs Brit. Isles 1: 678. 1914; Bailey, Stand. Cycl. Hort. 3: 1731. 1915; Mori, Enum. Pl. Corea 165. 1922; Rehder, Man. Cult. Trees and Shrubs 260. 1927, ed. 2. 255. 1940; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 354. 1931; Nakai, Fl. Sylv. Koreana **20:** 108. *tab. 21.* 1933; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936.

Futó Kádsura, sive Sáne Kádsura, aliis Orenj Kádsura Kaempf. Amoen. Exot. 476. *fig.* 1712.

Futokadsura ou Sanekadsura Kaempf. Hist. Jap. 2: Append. 26. *tab. 42* (err. *22*). 1729.

Uvaria japonica L. Sp. Pl. 536. 1753; Thunb. Fl. Jap. 237. 1784; J. F. Gmel. Syst. Nat. 2: 868. 1791.

Cadsura japonica Dunal ex Spreng. Syst. Veg. 2: 642. 1825.

Schizandra japonica Baill. Hist. Pl. 1: 150. *fig. 185–190.* 1868–69; non Sieb. & Zucc. ex A. Gray, nomen (1859).

Kadzura japonica Juss. ex Sugimoto, Key Trees and Shrubs Japan 87. 1936.

Apparently dioecious (but probably sometimes monoecious), glabrous throughout, with often obvious axillary buds, these ovoid, up to 5 mm. long, composed of numerous imbricate papyraceous broadly deltoid bracts; branchlets slender, the young ones brownish or purpurascent, 1.5–3 mm. in diameter, the older ones often cinerascent, up to 4 mm. in diameter; bud-scales several, papyraceous, broadly deltoid, rounded, about 2 × 2.5 mm., fugacious; leaves 3–12 per annual shoot, sometimes subpersistent, the shoots sometimes abbreviated; petioles 7–30 mm. long, 1–1.5 mm. in diameter; leaf-blades chartaceous, when dried dark olivaceous or brownish on both surfaces, oblong- or obovate-elliptic, (3.5–) 5–13 cm. long, (1.5–) 2.5–6 cm. broad, obtuse or subacute at base, gradually narrowed or cuspidate to an obtuse apex 3–10 mm. long, serrate-denticulate at least in the distal half with callose-apiculate teeth 1 or 2 per centimeter, often obscurely yellow-glandular beneath, the costa plane or slightly impressed above, prominent beneath, the secondary nerves 4–8 per side, subspreading, slightly curved, prominulous above, lightly elevated beneath, the veinlet-reticulation prominulous on both surfaces; flowers axillary, solitary, the subtending bracts several, papyraceous, broadly deltoid, about 1 × 1.5 mm., caducous; ♂ flowers: pedicels 10–30 mm. long at anthesis, slender, 0.5–1 mm. in diameter, slightly swollen distally, with 2–5 bracteoles, these papyraceous, deltoid, obtuse, ciliolate, 0.8–1.8 mm. long; perianth-segments 9–17, the outer ones papyraceous, pellucid-glandular, usually ciliolate, the inner ones thin-carnose, immersed-glandular, eciliate, the outermost 2–5 bracteole-like, ovate-deltoid or oblong, 1.2–5 × 1.5–6 mm., the largest ones elliptic to obovate, 7–14 × 4–10 mm., the innermost reduced to about 4 × 3 mm.; androecium subglobose or obovoid, at anthesis 5–9 mm. in diameter, the stamens 6–8-seriate, 34–55, the free filaments short (1 mm. long) or essentially none, the connective usually obviously yellow-glandular, 1.5–3 mm. broad, 0.5–1 mm. thick, truncate at apex, the thecae 0.5–1.2 mm. long; ♀ flowers: pedicels as in ♂ but sometimes 35–60 mm. long at anthesis; perianth-segments as in ♂; gynoecium subglobose, about 5 mm. in diameter at anthesis; carpels 4–6-seriate, 36–50, the ovary obovoid, about 1.5 mm. long and broad at anthesis, flattened at apex, the stigmatic crests membranaceous, terminated by an irregularly peltate pseudostigma 0.4–0.7 mm. in diameter, the ovary-wall uniform in thickness or only slightly thicker distally, the ovules 2 or 3; fruiting pedicels at maturity 15–50 (–60) mm. long, up to 2 mm. in diameter, the heads subglobose, at apparent maturity 2–3 cm. in diameter, the torus carnose, flattened in drying, ellipsoid, usually 10–20 × 8–20 mm.; mature carpels 20–50, subglobose, 6–9 mm. in diameter, the pericarp thin-carnose, fairly uniform in thickness, showing shape of seeds when

dried; seeds 2 or 3, rarely 1, reniform-ellipsoid, 5–6 mm. long, 3.5–5 mm. broad, the hilar indentation obvious, on long axis, the testa castaneous.

TYPE LOCALITY: Japan; the Linnaean binomial is based exclusively upon Kaempfer's description and plate of 1712.

DISTRIBUTION: Japan (central Honshu and Oki Island southward) to southern Korea and southward through the Ryu Kyu Islands, at low elevations (probably not exceeding 500 m.) in thickets or forests. See map, *fig. 37*.

JAPAN: *H. Zollinger 426* (A). HONSHU: Saitama Pref.: [Musashi: Tatsukawa], *K. Sakurai,* July 21, 1910 (US); Tokyo Pref.: Tokyo, *Collector?,* May 1888 (US), *K. Sakurai,* Sept. 5, 1905 (A), Aug. 19, 1912 (A); Kanagawa Pref.: Yokohama, *C. Maximowicz* in 1862 (K); Gifu Pref. [Mino Prov.]: *K. Shiota 4433* (A), *9133* (A); Hyogo Pref.: Rokko-san, near Kobe, *K. Uno 4202* (NY); Osaka Pref.: Sano, Boshu, *Collector?,* Oct. 27, 1894 (US); Okayama Pref.: [Bizen Prov.]: *G. Masamune,* Aug. 13, 1920 (NY). SHIKOKU: Kochi Pref.: Nakaokuyama, Prov. Tosa, *Collector?,* Sept. 25, 1891 (K). KYUSHU: Nagasaki Pref.: Nagasaki, *C. Maximowicz* in 1863 (GH, K), *R. Oldham 25* (K), *26* (K), *849* (K), *Suppl.* (K); Kagoshima Pref.: Higashi-Kirishima, *E. H. Wilson 6203* (A). YAKUSHIMA: *E. H. Wilson 6092* (A).

RYU KYU ISLANDS: *C. Wright* (U. S. Expl. Exped. 1853–56) (GH, US), Comm. Yokohama Nursery Co. (A). OKINAWA: Kunigami-gun, *R. Kanehira 3263* (NY). ISHIGAKI: *J. L. Gressitt 613* (A, NY).

KOREA: KEINAN and ZENNAN: No specimens seen from these provinces, but several cited by Nakai in Fl. Sylv. Koreana **20**: 109. 1922. QUELPAERT: Vicinity of Saishu, *E. H. Wilson 9361* (A, K); "in silvis Hongno," *T. Taquet 2592* (A, K), *2593* (A, K); without detailed locality, *U. Faurie 1679* (A).

CULTIVATED: *C. S. Sargent,* Oct. 8, 1892 (A) (Agr. College, Tokyo); *E. Lawrence,* Aug. 1936 (A) (Raleigh, N. Carolina); *G. Vasey* in 1879 (US) ("greenhouse"); *G. Nicholson 2152* (A) (Kew Gardens); Comm. The Marquis of Headfort, Sept. 28, 1938 (K) (Kells, Co. Meath, I. F. S.); *A. Braun* (M) (Hort. Berlin); *A. Rehder 2046* (A) (Hort. Göttingen).

LOCAL NAMES, USES, and COLOR NOTES: The names most often reported from Japan are: *Sane-kadsura, Binan-kadsura,* and *Futo-kadsura* or variants. Reported by only one or two authorities are: *Orenj-kadsura, Binan-so, Tororo-kazura,* and (Tsushima Island, from Matsumura) *Dororí-kazura.* From the Ryu Kyu Islands *Andakajâ* or a variant is reported; from Quelpaert Island *Pusun* or *Pusumi* (by Nakai).

Several authorities record the use of the fruit as a "medicine," while the plant is said to yield a mucilaginous fluid used in paper-making or as a hair-dressing.

Color-notes are sparse, but probably the perianth-segments are yellow and the androecium and gynoecium red. Anthesis occurs between May and September (in one case in February, on Yakushima). Mature fruits have been observed from September to November (or January in the Ryu Kyu Islands); I find no mention of the fruit-color.

SYNONYMY: Dunal's binomial is based upon *Uvaria japonica* L., which in turn is founded upon Kaempfer's *Futó Kádsura,* etc. of 1712. Since there is no extant type, this species thus rests upon Kaempfer's plate, which unmistakably portrays the common Japanese *Kadsura.* This species is the type of the genus *Kadsura.*

Taxonomic evaluation of the geographical parts of § *Eukadsura* has proved very difficult, with the exception of a few readily recognized peripheral elements (*K. induta, K. oblongifolia, K. angustifolia,* and *K. interior*). To a lesser degree such species as *K. polysperma* and the two Philippine elements, *K. philippinensis* and *K. paucidenticulata,* are also recognizable with reasonable ease. There remains a great bulk of material, ranging from Japan to India and southward to Sumatra, in which specific lines can hardly be sharply drawn. In general I have found that only fruiting characters satisfactorily separate the material from Japan, Korea, the Ryu Kyus, and Formosa from the continental and southern material of § *Eukadsura.* The fruiting carpels of the insular and northern material tend to have a pericarp of uniform thickness, apparently very soft, and flattening in drying to show the outline of the seeds. The continental and southern specimens, however, have the fruiting pericarp thicker, especially distally, and not flattening

in drying, so that the shape of the seeds cannot be seen without dissection. Poor as this character is, it seems reliable when taken in conjunction with certain intangible (or at least not entirely reliable) foliage characters, and it permits one to limit *K. japonica* to a reasonable geographical area. A summary of the slight differences between insular and continental material is expressed in my key to species.

The characters which permit the removal of the Formosan specimens (as *K. Matsudai*) from a broad interpretation of *K. japonica* are utilized in my key to species, although their value may well be questioned. I feel but little confidence

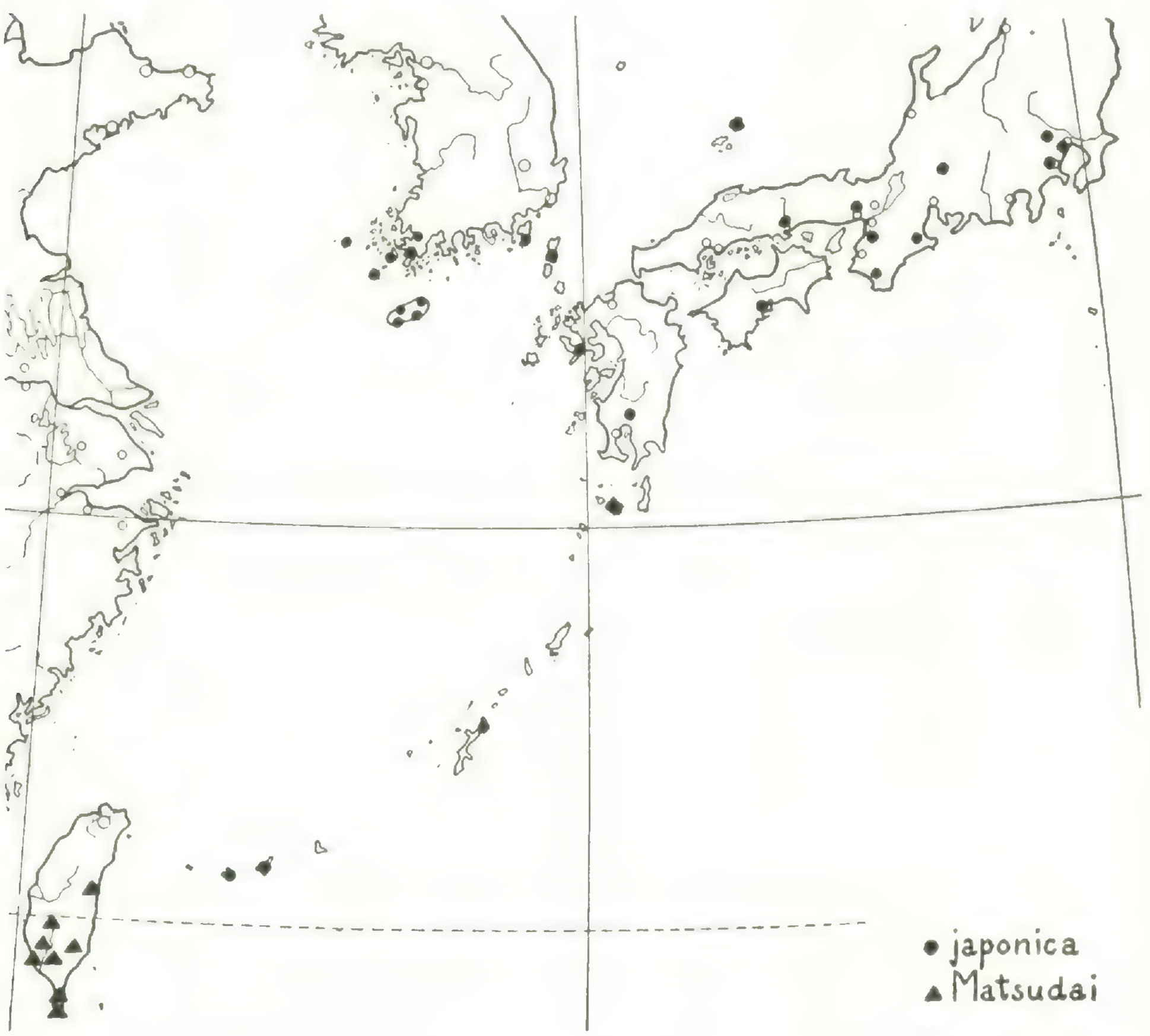

FIG. 37. Approximate known distribution of *Kadsura japonica* and *K. Matsudai.*

in such criteria as degree of dentation of leaf-margins, glandulosity of the perianth, and color and size of seeds. However, since the Formosan entity has been dignified with a binomial and is distinguishable, however inadequately, I keep it as a distinct species in this treatment. The dividing line between these two concepts is taken, for the time being, as lying between Formosa and the southernmost Ryu Kyus, but I have not seen enough material from that region to permit valid conclusions. My distribution map shows *K. japonica* extending southward through all the Ryu Kyu Islands, with localities taken from Ito & Matsumura (in Jour. Coll. Sci. Tokyo **12**: 285. 1900).

9. **Kadsura** (§ *Eukadsura*) **Matsudai** Hayata, Ic. Pl. Formos. **9**: 4. 1920; Sasaki, Cat. Gov. Herb. (Taihoku) 215. 1930; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 355. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 239. 1936.

Kadsura japonica sensu Sasaki, Cat. Gov. Herb. (Taihoku) 215, p. p. 1930; non Dunal.

Apparently dioecious, glabrous throughout, the young branchlets brownish or purpurascent, 1.5–4 mm. in diameter, sometimes shortened, the older ones often cinerascent, up to 6 mm. in diameter; bud-scales as in *K. japonica;* leaves 4–14 per annual shoot; petioles 8–20 mm. long, about 1 mm. in diameter; leaf-blades papyraceous, brownish or dark olivaceous on both surfaces, elliptic- or lanceolate-oblong, (5–) 6–11 cm. long, (2–) 2.5–5.5 cm. broad, obtuse at base, obtuse at apex or cuspidate or short-acuminate with an obtuse acumen 3–10 mm. long, often subentire at margin, sometimes remotely denticulate or serrate-denticulate distally with callose-apiculate teeth about 1 per centimeter, the costa shallowly impressed above, prominent beneath, the secondary nerves 4–6 per side, subspreading, slightly curved, faintly raised on both surfaces, the veinlet-reticulation prominulous on both surfaces; flowers axillary and solitary or borne on branchlets below leaves, the subtending bracts as in *K. japonica;* ♂ flowers: pedicels 6–15 mm. long at anthesis, about 1 mm. in diameter, with 2–4 bracteoles, these papyraceous, deltoid, about 1 mm. long; perianth-segments 8–13, papyraceous to submembranaceous, copiously yellow-glandular without, the outermost few deltoid to oblong, obtuse, 1.5–5 mm. long and broad, the largest ones elliptic to obovate, 9–12 × 4.5–7 mm., the innermost few slightly reduced; androecium essentially as in *K. japonica,* 5–7 mm. in diameter, the stamens about 50 and 8-seriate, the connectives copiously yellow-glandular at apex, the thecae 0.6–0.7 mm. long; ♀ flowers: pedicel as in ♂ but 20–40 mm. long at anthesis; perianth-segments as in ♂; gynoecium essentially as in *K. japonica,* about 4 mm. in diameter; carpels 40–50 (as observed), about 4-seriate, the ovules 2–4; fruiting pedicels at maturity 30–60 mm. long, slender, the heads as in *K. japonica;* mature carpels 25–50, 6–10 mm. in diameter, the seeds 2–4, 4–5 mm. long and 3.5–4.3 mm. broad, the testa brown, darker in color than that of *K. japonica.*

TYPE LOCALITY: Ariko, Formosa; type, *Y. Matsuda,* Jan. 1917.

DISTRIBUTION: Formosa, presumably in montane forest at altitudes up to 2000 m. See map, *fig. 37.*

FORMOSA: Arisan, *E. H. Wilson 9709* (A, K); Takao, *E. Matuda 277* (A), *554* (UC); vicinity of Kuraru, Prov. Koshun, *E. H. Wilson 11044* (A, K, US); Bankinsing Mountains, *A. Henry 1553* (A, K, US), *1681* (K, US); South Cape, *A. Henry 1284* (A, K, NY).

COLOR NOTES: In one of Wilson's cited collections the flowers are said to be white, and in the other red, while other collectors have apparently failed to note the color. Flowers have been obtained in April, November, and January. Fruits are red and have been observed in October and January.

SYNONYMY: As *K. japonica,* Sasaki cites several specimens from Formosa which I believe must represent *K. Matsudai.*

The unsatisfactory nature of the characters separating *K. Matsudai* from *K. japonica* has been discussed under the latter species.

10. **Kadsura** (§ *Eukadsura*) **longepedunculata** Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 53. *pl. 8, B, 8–15.* 1905 [repr. Contr. Fl. As. Or. **2**: 53. 1907].

? Kadsura discigera Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 52. *pl. 8, A, 1–7.* 1905 [repr. Contr. Fl. As. Or. **2**: 52. 1907].

Kadsura japonica sensu Dunn & Tutcher in Kew Bull. Add. Ser. **10**: 29. 1912; Hand.-Maz. Symb. Sin. **7**: 245. 1931; non Dunal.

Schizandra axillaris sensu Diels in Bot. Jahrb. **29**: 322. 1900; non Hook. f. & Thoms.

Kadsura peltigera Rehder & Wilson in Sargent, Pl. Wils. **1**: 410. 1913, in Jour. Arnold Arb. **8**: 110. 1927; Hand.-Maz. Symb. Sin. **7**: 245. 1931; W. C. Cheng in Contr. Biol. Lab. Sci. Soc. China **9**: 284. 1934; C. Y. Cheng in Pl. Omeiens. **1** (2): *pl. 74*. 1944.

Monoecious, or often apparently dioecious, glabrous throughout, the axillary buds occasionally obvious, small; young branchlets usually dark purpurascent and 1–3 mm. in diameter, the older ones often cinerascent, up to 8 mm. in diameter; bud-scales several, subcoriaceous, broadly deltoid, 1–2 × 2–4 mm., fugacious; leaves (2–) 3–12 per annual shoot, these sometimes abbreviated; petioles (6–) 8–20 (–27) mm. long, 0.7–1.5 mm. in diameter; leaf-blades papyraceous to chartaceous or rarely thin-coriaceous, when dried dark brown to dark olivaceous and often shining above, slightly paler beneath, oblong- to obovate-lanceolate or oblong-elliptic, (4–) 7–11.5 (–13) cm. long, (1.5–) 2.5–5.5 cm. broad, attenuate or acute or sometimes obtuse at base, acuminate or cuspidate to an obtuse apex 3–10 mm. long, obviously serrate-denticulate at least distally with callose-apiculate teeth about 1 per centimeter, these rarely obscure, often yellow-glandular beneath and obscurely so above, the costa subplane or slightly impressed above, prominent beneath, the principal secondary nerves 5–7 per side, usually ascending, slightly curved, raised on both surfaces, the veinlet-reticulation sometimes intricate, prominulous on both surfaces or rarely subimmersed; flowers axillary, solitary, subtended by a few subpersistent basal bracts, these subcoriaceous or papyraceous, broadly deltoid, 1–2 × 2–3 mm., ciliolate; ♂ flowers: pedicels very variable, at anthesis 7–45 mm. long and 0.7–1.5 mm. in diameter, with 2–6 scattered bracteoles, these papyraceous or membranaceous, oblong-deltoid, subacute to rounded, 1.5–3 mm. long and broad, ciliolate; perianth-segments (rarely 8–) 10–17, several-seriate, the outer ones papyraceous, obscurely yellow-glandular and cilioate, the inner ones increasingly carnose, eciliate, the outermost 2–4 ovate-deltoid, obtuse, 1.2–3 × 1.5–3.5 mm., the largest ones elliptic, 8–14 × 4–10 mm., the innermost few obovate-elliptic, reduced in size, often thick-carnose; androecium ellipsoid-subglobose, at anthesis 5–8 × 5–7 mm., the column about 2 mm. in diameter at base, the stamens 5–9-seriate, (rarely 30–) 37–70, the free filaments minute or essentially none, the connective 1.5–2.5 mm. broad, 0.5–1 mm. thick, obscurely yellow-glandular on the flattened apex, the thecae obliquely lateral, 1–1.5 mm. long; ♀ flowers: pedicels usually much longer than in ♂, very variable, at anthesis 15–105 (–160) mm. long, up to 2 mm. in diameter distally, bracteolate as in ♂; perianth-segments as in ♂; gynoecium ellipsoid, at anthesis 4.5–8 × 4–7 mm.; carpels 5- or 6-seriate, 40–60, the ovary oblong-obovoid, at anthesis 1.3–2 × 1–1.5 mm., angled by mutual pressure, broadest at the flattened or convex apex, the walls thick-carnose especially distally, obscurely yellow-glandular, the stigmatic crests membranaceous, ciliolate, terminated by a peltate pseudostigma 0.3–1 mm. in diameter, proximally extended into 1 or 2 linear lobes (sometimes suppressed), the ovules 2 or 3, rarely 4 or 5, collateral or superposed; fruiting pedicels variable in length, at maturity (15–) 30–130 (–170) mm. long, not much enlarged in diameter, the heads 2.5–3.5 cm. in diameter approaching maturity, the torus coriaceous, ellipsoid, 10–25 × 5–12 mm.; mature carpels usually 40–60, obovoid, 8–14 × 7–11 mm. (apparently mature), the pericarp thick-carnose, usually not flattening in drying to show shape of seeds, slightly thicker distally than proximally; seeds 2 or 3, rarely 4 or 5, superposed or collateral-superposed, ellipsoid to reniform, 5–6.5 × 4–5 mm., the hilar indentation slight, on long axis, the testa dull brown or pale brown. FIG. 36, f–j.

TYPE LOCALITY: Ch'eng-k'ou ["Tchen-kéou"] district, eastern Szechuan; the type is a collection by Farges, not available to me.

DISTRIBUTION: Eastern and south-central China, from Chekiang to Hupeh and Szechuan, and thence southward to Kwangtung, Kwangsi, and Kweichow, at recorded altitudes of 100–1200 m. See map, *fig. 38*. Various habitats have been recorded, including mixed woods,

wooded hillsides, forests, thickets, open or rocky slopes and valleys, stream-banks in ravines, etc.

CHINA: CHEKIANG: Ch'ang-hsing Hsien, *K. Ling 12427* (UC); Hangchow (Hang Hsien), *C. Y. Chiao 18910* (NY, US); Ningpo (Yin Hsien), *E. Faber 1719* (K); T'ien-t'ai Shan, *C. Y. Chiao 14517* (A, UC); T'ien-mu Shan, *R. C. Ching 5043* (A), *W. Y. Hsia 157* (A); Ch'ang-hua Hsien, *F. N. Meyer 1531* (A, K), *Y. L. Keng 616* (A, UC); Sui-an Hsien, *H. H. Hu 565* (A, K, Man, UC), *Y. L. Keng 792* (UC); northeast of T'ai-shun, *R. C. Ching 2176* (A, UC, US); T'ai-shun, *Y. L. Keng 242* (A); Ch'ing-yüan Hsien, *R. C. Ching 2570* (A, US); Yen-tang Shan, Chang-chung-tung, *C. Y. Chiao 14780* (A, UC, US); without definite locality, *H. H. Hu 25* (K). ANHWEI: Ch'ing-yang Hsien, *K. Ling 1125 (7715)* (UC); Chiu-hua Shan, *C. S. Fan & Y. Y. Li 19* (US); Ch'i-men, *N. K. Ip 40 (7665)* (UC); Li-kan, W. Ch'i-men Hsien, *R. C. Ching 3159* (A, K, UC); Wu-yüan, *K. Ling 1328 (7865)* (UC). HUPEH: Pao-k'ang, *E. H. Wilson 2149* (K); Ch'ang-yang, *A. Henry 7496* (K); Tung-hu, *A. Henry 6433* (K, NY). SZECHUAN: O-mei Shan, *C. Y. Chiao & C. S. Fan 349* (A); P'ing-shan Hsien, *W. P. Fang 6368* (A, NY, US). FUKIEN: Yen-p'ing, *H. H. Chung 2903* (A, K, UC); Ku-ling and vicinity, *H. H. Chung 6632* (A, NY), *7552* (A), *S. G. Tang 6795* (UC); Nang-yang, *H. C. Chen 1274* (UC); Ku-ling Hills, near Min-hou, *J. B. Norton 1371* (US); Min-hou (Fu-chou), *W. R. Carles 636* (K), *691* (K); Peh-ling, Min-hou (Fu-chou), *H. H. Chung 2052* (A, K, UC); Ch'ang-lo Hsien [Diongloh], *P. E. Chen 2638* (UC); "Baek-liang" and vicinity, *H. C. Chen 3033* (UC), *3127* (UC), *3194* (UC); without detailed locality, *F. P. Metcalf & T. C. Chang 515* (UC). KIANGSI: Chiu-chiang, *A. Allison 15* (A); Ku-ling, *E. H. Wilson 1735* (A, US), *1736* (A type of *K. peltigera,* US), *1737* (A), *C. Y. Chiao 18628* (NY, US), *18667* (NY), *18727* (NY, US); Lu Shan, *H. H. Chung & S. C. Sun 580* (A), *602* (A, NY); K'u-yüan, I-huang, *Y. Tsiang 10011* (NY); near Sa-tiu-hong, Yung-shui, *Y. Tsiang 10611* (NY); Oo-chi Shan, near Lam-uk Village, Lung-nan Hsien, *S. K. Lau 4603* (A, US); Sai-hang-cheung, near Tung-lei Village, Ch'ien-nan Hsien, *S. K. Lau 4014* (A, US), *4260* (A, US). HUNAN: "Ad minas Hsikwangschan," near Hsin-hua, *H. v. Handel-Mazzetti 812* (A); Yang Shan, Ch'ang-ning Hsien, *C. S. Fan & Y. Y. Li 228* (A); Yün Shan, Wu-kang Hsien, *H. v. Handel-Mazzetti 370* (A); Ma-ling-tung, Hsin-ning Hsien, *C. S. Fan & Y. Y. Li 609* (A). KWEICHOW: She-won-san, Hsi feng Hsien, *S. W. Teng 90454* (A); Pa-chai, *Y. Tsiang 6137* (NY); "Yunnan-sen District," *J. Cavalerie 3336* (K), *7112* (K), *7113* (K). KWANGTUNG: Chong-uen Shan, near Kau-fung, Lo-ch'ang Hsien, *W. T. Tsang 20826* (A, K, M, NY, UC); North River, Herb. Hongk. Bot. Gard. 114 (K); Yao Shan, North River region, *S. S. Sin 11084* (NY); Tsing-wan Shan, Wong-chuk-i and vicinity, Weng-yüan Hsien, *S. K. Lau 2342* (A); Lo-fou Shan, *E. D. Merrill 11015* (NY, UC), C. C. C. Herb. 1568 (GH, M); Sin-tong, Mao-ming [Kochow], *Y. Tsiang 965* (A, UC); Shih-wan-ta Shan, *H. Y. Liang 69963* (A); vicinity of "Yunchow," *H. Y. Liang 70113* (A). KWANGSI: Ling-wang Shan, San-chiang Hsien, *A. N. Steward & H. C. Cheo 989* (A).

LOCAL NAME and COLOR NOTES: *Sai-ng'ang-f'an-tün* (noted by Tsang, in Kwangtung) is the only local name I have found assigned to the concept described above. Several collectors have noted the fruit as edible.

The perianth-segments vary from white or cream-colored to yellow, and the androecium and gynoecium are described as purple to brownish or black; the flowers are often said to be fragrant. Anthesis occurs between June and August. Mature fruits have been obtained from August to December; they are red at first, becoming purple or black.

SYNONYMY: The entity described above, the most common *Kadsura* in eastern and central China, has been passing in herbaria as *K. peltigera,* but in my opinion this concept has at least one earlier name, and perhaps two, established by Finet & Gagnepain in 1905. *Kadsura longepedunculata* is typified by a Farges collection from "district de Tchen-kéou" [Ch'eng-k'ou Hsien], Szechuan. Although I have seen no Farges material of this entity, the specimen, with ♀ flowers, is adequately described and well illustrated. There can be no doubt that the common Chinese *Kadsura* with long ♀ pedicels and denticulate leaf-blades is represented.

Kadsura discigera, published at the same time as *K. longepedunculata,* is similarly based upon a ♀ specimen collected by Farges near Ch'eng-k'ou. In foliage the two type specimens appear to be essentially similar, but *K. discigera* is said to have much shorter pedicels and larger flowers. The largest perianth-segments are said to be 25 × 12 mm. In the numerous flowers of the common Chinese *Kadsura* which I have dissected no perianth-segments larger than 14 × 10 mm. have been observed. If the stated difference should be substantiated, *K. discigera* may well merit specific status. It is possible, however, that Finet & Gagnepain

erred in their observations; I find it difficult to believe that two species of § *Eukadsura* occur in this part of Szechuan. For the time being I refer *K. discigera* to synonymy with a question. Since there is no precedent for the combination of these two binomials, I have selected *K. longepedunculata* for maintenance, since there seems to be no doubt of the interpretation of this.

Kadsura peltigera is typified by *Wilson 1736,* from Kiangsi, cited above. Although this specimen has shorter ♀ pedicels than those of the type of *K. longepedunculata,* it is in all respects within the limits of a reasonable interpretation of the species. Pedicel-length is very variable in this complex and can be utilized only within very broad limits to separate allied species. As paratypes of *K. peltigera,* Rehder & Wilson cited two Yünnan collections of Henry which I consider better placed in *K. heteroclita.*

Diels' record of *Schizandra axillaris* is based upon *Henry 6433,* a Hupeh specimen which I cite above. This specimen is not entirely typical of *K. longepedunculata,* having short

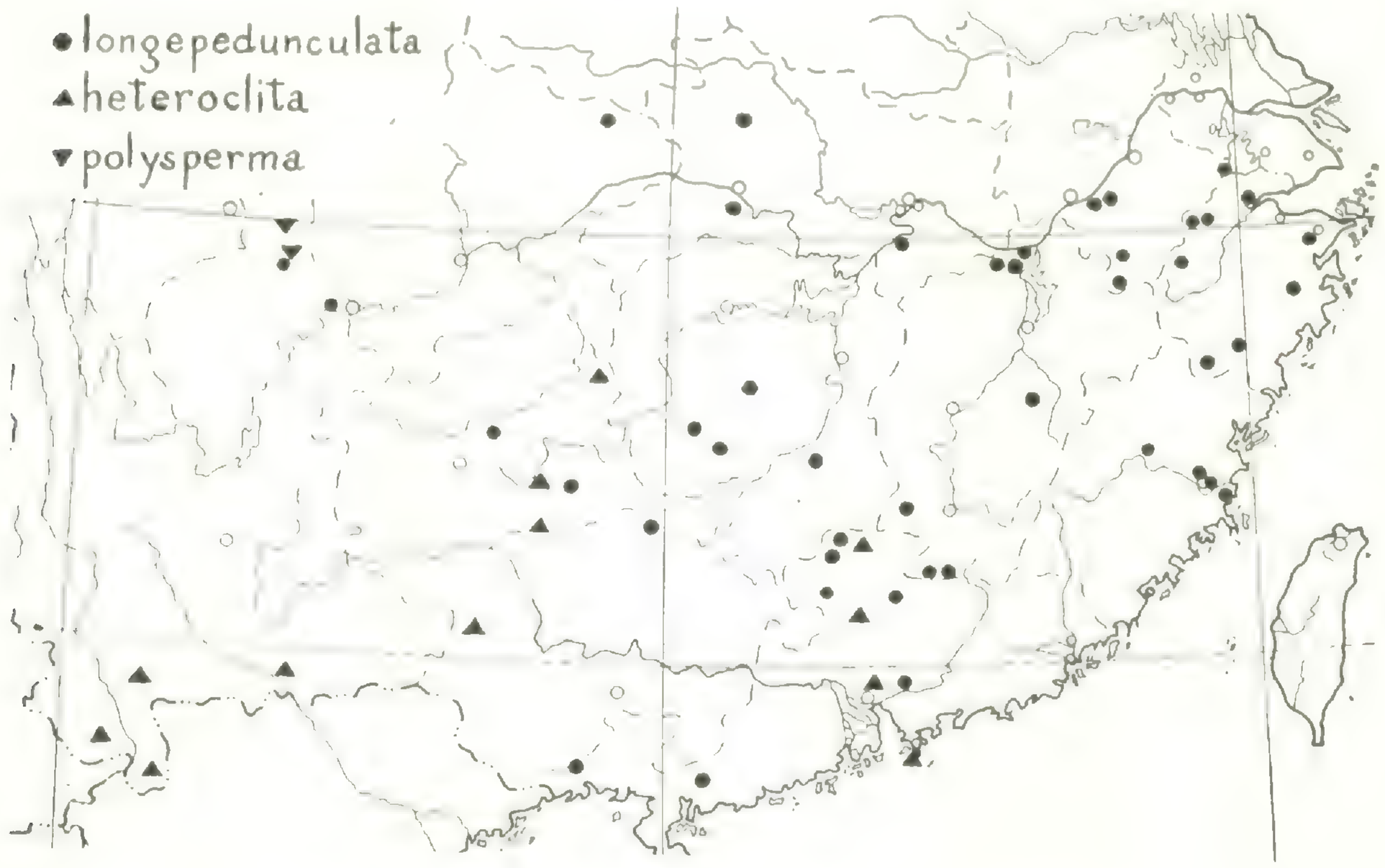

FIG. 38. Approximate known distribution of *Kadsura longepedunculata, K. heteroclita* (Chinese specimens only, excluding those of Hainan; see also *figs. 34* and *39*), and *K. polysperma.*

pedicels and comparatively few flower-parts, but it seems to fall into a broad concept of the species.

The extensive continental population of § *Eukadsura* of the immediate relationship of *K. japonica,* extending from Chekiang and Anhwei southward and westward to Hainan, Indo-China, Sumatra, Ceylon, and India, is very difficult to break up for nomenclatural purposes, although the extremes seem fairly diverse. Characters pertaining to the flowers, such as number and size of parts, do not offer dependable criteria in this case, as the variation, although considerable, is not too great for a single species and has no geographical basis.

Foliage differences pertaining to leaf-size, margins, and base are discernible in the extremes of the population. Thus, the specimens from India to southern China and southward have the leaf-blades predominantly slightly larger than specimens to the north, while their bases are less tapering and their margins are inclined to be entire or nearly so. Northern specimens have the leaf-blades aver-

aging smaller, often attenuate at base, and usually obviously denticulate or serrulate.

Differences in length of pedicel are noticeable, but there is a considerable amount of overlap. In general, specimens from the southern and western parts of the range of this complex have short pedicels, this being especially apparent in fruit, while those from the north are inclined to have elongate pedicels. The extremes in this character are very different.

The characters here discussed, and expressed in my key to species, are in general reliable, but some specimens seem intermediate in nature. Such intermediate specimens are most common in the regions where the two entities meet, as is to be expected, while toward the ends of the entire range the characters are fairly clear-cut. I see no reason to assume that the intermediate specimens are hybrids between two fixed entities; it seems more logical to assume in this case that the entire population is in the process of breaking up into two more or less stabilized forms. Whether these forms are recognized as species or subspecies seems immaterial. Since specific names already exist for them, and since the extremes are very distinct and readily distinguished, it seems advisable to recognize two species for this complex, *K. longepedunculata* for the northern component and *K. heteroclita* for the southern and western one.

11. **Kadsura** (§ *Eukadsura*) **heteroclita** (Roxb.) Craib, Fl. Siam. Enum. **1**: 28. 1925; Alston in Trimen, Hand-book Fl. Ceylon **6**: 4. 1931.

Uvaria heteroclita Roxb. Hort. Beng. 43, nomen. 1814, Fl. Ind. ed. 2. **2**: 663. 1832; Griffith, Notul. Pl. As. **4**: 711, Ic. **4**: *pl. 649, fig. 2.* 1854.

Kadsura japonica sensu Wall. Fl. Tent. Napal. 12. 1824, Cat. n. 4987. 1832; non Dunal.

Kadsura Roxburghiana Arn. in Mag. Zool. and Bot. **2**: 546. 1838; Hook. f. & Thoms. Fl. Ind. **1**: 83. 1855; Walp. Ann. Bot. **4**: 78. 1857; Drury, Hand-book Ind. Fl. **1**: 647. 1864; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 45. 1872; King in Jour. As. Soc. Beng. **58** (2) : 376. 1889, in Ann. Bot. Gard. Calcutta **3**: *222. pl. 73, A.* 1891; Parment. in Bull. Sci. Fr. & Belg. **27**: 235, 237, 312. *pl. 8, fig. 7, pl. 11, fig. 44, 45.* 1896; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 52. 1905 [repr. Contr. Fl. As. Or. **2**: 52. 1907]; Brandis, Indian Trees 9. 1906; Finet & Gagnep. in Lecomte, Fl. Gén. Indo-Chine **1**: 41. 1907; Dunn & Tutcher in Kew Bull. Add. Ser. **10**: 29. 1912; Gamble, Fl. Pres. Madras **1**: 10. 1935; Kanj., Kanj., & Das, Fl. Assam **1**: 29. 1935.

Kadsura Wightiana Arn. in Mag. Zool. and Bot. **2**: 546. 1838; Walp. Rep. Bot. Syst. **1**: 92. 1842; Hook. f. & Thoms. Fl. Ind. **1**: 84. 1855; Walp. Ann. Bot. **4**: 78. 1857; Thwaites, Enum. Pl. Zeyl. 5. 1858; Drury, Hand-book Ind. Fl. **1**: 648. 1864; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1**: 45. 1872; King in Ann. Bot. Gard. Calcutta **3**: *222. pl. 74, B.* 1891; Trimen, Hand-book Fl. Ceylon **1**: 16. 1893; Parment. in Bull. Sci. Fr. & Belg. *27*: 238, 314. 1896; Brandis, Indian Trees 9. 1906.

Sphaerostemma Blumiana Griffith, Notul. Pl. As. **4**: 714, Ic. **4**: *pl. 651, fig. 1, 2, pl. 654.* 1854.

Kadsura Wattii Clarke in Jour. Linn. Soc. Bot. **25**: 4. 1889.

Kadsura Championi Clarke in Jour. Linn. Soc. Bot. **25**: 4. 1889.

Kadsura Roxburghiana var. *macrocarpa* Parment. in Bull. Sci. Fr. & Belg. **27**: 237. 1896.

Kadsura acuminata Parment. in Bull. Sci. Fr. & Belg. **27**: 238, 315. 1896.

Schizandra elongata var. *dentata* Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 49, p. p. 1905 [repr. Contr. Fl. As. Or. **2**: 49. 1907].

Kadsura lanceolata sensu Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 53, p. p. 1905 [repr. Contr. Fl. As. Or. **2**: 53. 1907], in Lecomte, Fl. Gén. Indo-Chine **1**: 42, p. p. 1907; non King.

Schizandra crassifolia Pierre ex Finet & Gagnep. in Bull. Soc. Bot. Fr. **54**: 85, p. p. 1907, in Lecomte, Fl. Gén. Indo-Chine **1**: 40, p. p. *fig. 8 (1, 2)*. 1907; Craib, Fl. Siam. Enum. **1**: 27. 1925; Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1**: 56. 1938.

Schizandra propinqua sensu Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine 1: 56. 1938; non Baill.

Kadsura peltigera sensu Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine 1: 59. 1938; non Rehder & Wilson.

Monoecious, or often apparently dioecious, glabrous throughout, occasionally with ellipsoid axillary buds up to 10 mm. long composed of numerous papyraceous imbricate bracts; young branchlets purpurascent or brownish to stramineous, 1–4 mm. in diameter, the older ones often cinerascent, up to 12 mm. in diameter; bud-scales several, subcoriaceous, broadly deltoid, up to 1.5 × 4 mm., fugacious; leaves 4–15 per annual shoot; petioles 5–22 (–40) mm. long, 0.7–2 mm. in diameter; leaf-blades papyraceous or chartaceous, when dried dark brown to dark olivaceous above and slightly paler beneath, ovate- to lanceolate-elliptic or broadly elliptic, (6–) 8–17 cm. long, (2–) 3–8.5 cm. broad, broadly obtuse or subacute at base, gradually acuminate or cuspidate to an obtuse apex 5–15 mm. long, entire and narrowly recurved at margin or occasionally remotely denticulate distally with 1 or 2 callose-apiculate teeth per centimeter, pale-glandular on both surfaces or often obscurely so, the costa sharply impressed to nearly plane above, prominent beneath, the secondary nerves 7–11 per side, subspreading or subascending, slightly curved, usually raised on both surfaces, the veinlet-reticulation often intricate, prominulous on both surfaces, occasionally subimmersed above and rarely beneath; flowers axillary and solitary or sometimes arising from defoliate lower portions of annual shoots, the subtending bracts few, papyraceous or subcoriaceous, deltoid, usually 1.5–2 mm. long and broad, fugacious; ♂ flowers: pedicels at anthesis (1–) 3–20 (–28) mm. long, 1–1.7 mm. in diameter, slightly swollen distally, with 2–6 scattered bracteoles, these papyraceous, deltoid to suborbicular, often ciliolate, 0.7–2 × 1–3 mm.; perianth-segments 11–15, usually 4- or 5-seriate, the outer ones papyraceous, obscurely pellucid-glandular and ciliolate, the inner ones increasingly carnose, usually obscurely glandular and eciliate, the outermost 2–5 oblong-deltoid to subreniform, 1–7 × 1.5–8 mm., the largest ones elliptic to obovate, 8–16 × 5–12 mm., the innermost few slightly reduced, sometimes as small as 3.5 × 2 mm.; androecium ellipsoid, at anthesis 5–7 × 4–5.5 mm., the stamens 6–10-seriate, (35–) 50–65, the free filaments essentially none or up to 1.5 mm. long and gradually swollen into the connective, this (0.6–) 1–2 mm. broad, (0.3–) 0.5–1.5 mm. thick, truncate or slightly convex at apex, the thecae 0.5–1 mm. long; ♀ flowers: pedicels as in ♂ but rarely up to 45 mm. long at anthesis; perianth-segments as in ♂; gynoecium ellipsoid or subglobose, at anthesis 7–8 × 6–8 mm., the column ellipsoid to subclavate; carpels 4–6-seriate, 30–55, the ovary oblong-obovoid, angled by mutual pressure, 1.5–2.5 mm. long and broad at anthesis, truncate or slightly convex at apex, the wall slightly the thickest at apex, sometimes copiously immersed-glandular, the stigmatic crests inconspicuous or obvious and membranaceous, obscurely ciliolate, terminated by a peltate submembranaceous pseudostigma 0.3–1 mm. in diameter, the ovules 2 or 3, sometimes 4, rarely 5; fruiting pedicels rugulose, at maturity 7–30 (–45) mm. long and 1.5–5 mm. in diameter, the heads subglobose, 2.5–5 cm. in diameter approaching maturity, the torus coriaceous, ellipsoid, 10–20 × 6–10 mm.; mature carpels (10–) 40–55, obovoid, at apparent maturity 10–22 × 6–15 mm., the pericarp carnose, drying coriaceous and not showing shape of seeds, thickest distally; seeds 2 or 3, sometimes 4, perhaps very rarely 5, superposed or collateral-superposed, often separated by partial false dissepiments, ellipsoid or faintly reniform, 5–7 × 4.5–6 mm., the hilar indentation slight, on long axis (except sometimes on short axis of a crowded basal seed), the testa brown,

TYPE LOCALITY: Garo Hills, western Assam, India; type not designated.

DISTRIBUTION: Southern China (Kwangtung and Hainan, Kwangsi, Kweichow, and Yünnan) to Bengal and Sikkim, and thence southward to peninsular India, Ceylon, Andaman

Islands, and Sumatra, at recorded altitudes of 400–2000 m. See maps, *figs. 34, 38,* and *39.* Recorded habitats include woods, forests, jungles, brushy slopes, ravines along streams, etc.

CHINA: HONGKONG: *J. G. Champion 36* or *s. n.* (K type of *K. Championi*). KWANGTUNG: Heo-tse-ling, Lo-ch'ang Hsien, *Y. Tsiang 1404* (UC); Wan-tong Shan, Taai-tsan, Ying-te Hsien, *W. T. Tsang & K. C. Wong 2491* (C. C. C. 14352) (UC); T'ai Ho, *Y. K. Wang 3200* (NY). HAINAN: Left side of Li Ka, Lin-fa Shan, Lin-kao Hsien, *W. T. Tsang 320* (L. U. 15823) (A, K, NY, UC, US); Lin-fa Shan, Lin-kao and Tan Hsien, *W. T. Tsang 267* (L. U. 17016) (A, K, UC, US); Pao-t'ing, *F. C. How 73127* (A); Lo-an [Loktung], *S. K. Lau 27146* (A); Kan-en [Kumyan], *S. K. Lau 27865* (A); La-k'uei, *F. C. How 72334* (A); Yai Hsien, *H. Y. Liang 62198* (NY); Lio Village (Tang-han), Yai Hsien, *H. Y. Liang 62356* (A, K, NY); without detailed locality, *H. Y. Liang 65008* (NY), *C. Wang 34536* (A, NY, US). KWANGSI: Yeo-mar Shan, N. Hin-yen, *R. C. Ching 7193* (NY), *7232* (NY). KWEICHOW: Ma-chou Ho, Fan-ching Shan, *A. N. Steward, C. Y. Chiao, & H. C. Cheo 840* (A, Ch, NY); Tu-yün, *Y. Tsiang 6007* (NY); Tu-shan Hsien, *Y. Tsiang 6638* (NY). YÜNNAN: P'ing-pien Hsien, *H. T. Tsai 60440, 60487, 61107, 61333, 61426, 61481* (all A); Ssu-mao, *A. Henry 12312* (A, M, NY, US), *12312A* (A, K, US), *12312B* (M, NY), *12549* (K, NY); Fo-hai, *C. W. Wang 74356* (A), *77282A* (A), *77377* (A); Meng-la, Chen-yüeh Hsien, *C. W. Wang 80745* (A).

INDO-CHINA: TONKIN: Massif du Fan Si Pan, near Cha Pa, *A. Pételot 3762* (A, NY); Son Tay, *B. Balansa 4180* (K). LAOS: Xieng Khouang, prov. Tran Ninh, *E. Poilane 2372* (A).

SIAM: PAYAP: Doi Sutep, Chiang Mai, *A. F. G. Kerr 3296* (K, UC), *6678* (K). PUKET: Tasan, *C. B. Kloss 7051* (K).

BURMA: SAGAING: Myitkyina: "Namma to Nammun," *J. H. Lace 5149* (K).

INDIA: ASSAM: Manipur: "Kaithemubee," North Manipur, *C. B. Clarke 42082B & C* (K type of *K. Wattii*); Irong, *A. E. Meebold 5931* (K); Khasi and Jaintia Hills District: "Kalapani," *J. D. Hooker & T. Thomson,* Aug. 1850 (K); Khasi region, *J. D. Hooker 2420* (K), *J. D. Hooker & T. Thomson* (K, GH); Sylhet: *N. Wallich* (coll. *F. De Silva*) *4987* (type coll. of *K. Roxburghiana,* A, K, NY); *J. D. Hooker & T. Thomson* (A, GH, K, NY); Lushi Hills District: Sialsuk, *N. E. Parry 429* (K); Hmifang, *N. E. Parry 296* (K); Assam, without detailed locality, *W. Griffith* (K), *Jenkins* (cotype coll. of *K. acuminata,* NY); Assam?, Sonada Road, *K. Biswas 4680* (A); Assam?, *Simons 191* (K). BENGAL: "East Bengal," *W. Griffith 73* (GH, K); "W. Duars, Buxa Res." [Baksa Duar, Jalpaiguri District?], *J. S. Gamble 7699* (K); Darjeeling District: Darjeeling, *J. S. Gamble 9819* (K), *10002* (K); Sikkim: *G. King,* Jan. 22, 1876 (K); Mintogong, *C. B. Clarke 24957* (A); Dulkajhar, Terai, *C. B. Clarke 36592A* (K); Suriel, *E. H. Wilson,* Sept. 10, 1921 (A). MADRAS: Malabar District: *R. Wight 2478* (type coll. of *K. Wightiana,* K, NY). CEYLON: Hantane, *G. Gardner 35* (K); without detailed locality, *G. H. K. Thwaites 1028* (GH, K), *G. Walker* (K).

SUMATRA: Goenoeng "Sibayak," *H. S. Yates 1505* (NY, UC). GOUVT. OOSTKUST: Berastagi, *H. N. Ridley,* Feb. 1921 (K). RES. SUMATRA'S WESTKUST: Goenoeng Singgalang, *H. S. Yates 2520* (A, NY, UC).

LOCAL NAMES and COLOR NOTES: Recorded local names are: *Taai-ip-kwo-shan-lung-t'ang, Kwo-shan-lung-t'ang* (in Hainan, by Tsang); *Tubee-kura* (in Assam, by Roxburgh); *Theiarbawm* (in Assam, by Parry); *Mi-ja-ngew, Kang-mari* (in Assam, by Kanjilal et al.); *Nâm xôi* (in Indo-China, by Finet & Gagnepain). The fruit is considered edible at least in northern India, and some collectors report the plant to be used as "medicine."

Perianth-segments are usually pale yellow, or the outer segments are greenish and the inner ones yellow; the androecium and gynoecium are recorded as pink to purple or brown-red. Several collectors note the flowers as aromatic. Anthesis occurs between May and August in China; in India it may be delayed until September or October, in Siam until November, and in Sumatra flowers have been collected in both May and February. The fruits are said to be red or scarlet and to mature from September to December (in the north) and presumably later in the south.

SYNONYMY: The earliest binomial applicable to the species described above is clearly *Uvaria heteroclita* Roxb., listed as a *nomen nudum* in 1814 and subsequently validated by an adequate description in 1832. The binomial is based on material from "the Garrow hills and other mountainous districts in the vicinity of Silhet, . . ." [Garo Hills, western Assam, at about lat. 25°30′ and long. 90°30′]. Roxburgh's type material is not available to me, but from his description, based on specimens with flowers of both sexes and fruits, there can

be no doubt that the common Assam species of *Kadsura* was represented. The correct combination for this entity was not made until 1925, when Craib indicated its priority over *K. Roxburghiana.*

Wallich, in 1824 and again in 1832, referred to *Kadsura japonica* a specimen from Sylhet, Assam ("Crescit in montosis prope Sylhet, ubi detexit beatus M. R. Smith.—Specimina tam viventia quam sicca misit collector horti hujus F. De Silva . . ."). This specimen was listed in Wallich's Catalogue as no. *4987* and as such it is cited above; it is typical of the extensive Assam material.

In 1838 Arnott proposed two binomials for Indian *Kadsurae.* One of these, *K. Roxburghiana,* is based upon *K. japonica* sensu Wall. and consequently is to be typified by the De Silva specimen mentioned above. Arnott realized the identity of Wallich's *"K. japonica"* with *Uvaria heteroclita* Roxb., but under the existing nomenclatural standards he was not obliged to take up the earliest specific epithet; he doubtless preferred to honor Roxburgh with the new binomial.

Arnott's second binomial, *Kadsura Wightiana,* is typified by *Wight 2478,* from Malabar, cited above. This specimen, incidentally, is the source of the generic name *Pauslowia* or *Panslowia,* mentioned only in synonymy and referable to *Kadsura.* According to Arnott, *K. Wightiana* differs from *K. Roxburghiana* in "antheris haud immersis et ovario; . . .", the ovules being three rather than two. This character is not important, as the number of ovules varies from two to five throughout the range of the species as I interpret it. In other respects, the type collection of *K. Wightiana* and Ceylon material do not differ materially from Assam specimens.

Sphaerostemma Blumiana (sic) Griffith is poorly described and illustrated, but the androecium is so shown as to indicate that a species of § *Eukadsura* was under consideration. Although neither type nor locality is cited, it is quite probable that Griffith's own collections (perhaps those cited above from Assam or "East Bengal") were the basis of the binomial, which may be reduced to *K. heteroclita* with confidence.

Kadsura Wattii Clarke is typified by *Clarke 42082,* cited above. The type is a fruiting specimen from Manipur, eastern Assam; it differs slightly from some of the other Assam material in having rather large leaf-blades with obvious veinlet-reticulation, but in neither of these respects is it outstanding. The original drawing gives an exaggerated impression of the fineness of the veinlet-reticulation. The fruits are typical for *K. heteroclita;* the false dissepiment is perhaps more pronounced than usual in the Schisandraceae, but the presence or absence of this ingrowth between the seeds is a character of little consequence. I have no hesitation in reducing Clarke's binomial to synonymy.

In the same publication, Clarke correctly pointed out that *Kadsura chinensis* Hance (*K. coccinea* in the present treatment) contained the elements of two species; he selected, of the three original components of Hance's species, the specimens of Hance and Millett as typical. The remaining specimen, *Champion 36,* from Hongkong, was indicated as the type of the new species *K. Championi.* This type, a specimen with ♀ flowers and fruits, is cited above. In my opinion it cannot be distinguished from the Indian *K. heteroclita,* and it is quite typical of the material from southern China, including Hainan, which I refer to the older binomial.

Parmentier's work on the Magnoliacées cannot be highly commended for its clarity, but one entity under *Kadsura* must be accepted as validly published. This is *K. acuminata* Parment., based on three specimens from Assam, collected by Jenkins and Masters and deposited in the Calcutta herbarium. A Jenkins specimens, cited above by me, is doubtless a cotype collection; on the basis of this and the original discussion, I see no reason to exclude the entity from *K. heteroclita.*

Kadsura Roxburghiana var. *macrocarpa* Parment. is a *nomen subnudum,* being mentioned under a discussion of *K. Roxburghiana* as follows: "graines trés grosses, acuminées sur quelques échantillons (var. *macrocarpa*)." No specimen is cited and the entity appears to be without value.

Finet & Gagnepain's references to *K. lanceolata* cited above doubtless include at least some material of *K. heteroclita,* as may be assumed from their descriptions. However, other elements may be included in their concept; at least the specimen cited from Ningpo is doubtless *K. longepedunculata.*

Schizandra crassifolia Pierre is based on three specimens from Indo-China, *Pierre 2927* and *3321* and *Harmand 1419.* From a perusal of the original descriptions of Finet & Gagnepain, one must suspect that this concept is a mixture. The staminate plant (*fig. 8* [*1, 2*] in Fl. Gén. Indo-Chine) is doubtless referable to *Kadsura heteroclita,* while the pistillate plant probably represents *K. coccinea.* Finet & Gagnepain, as representing their *Schizandra*

elongata var. *dentata,* had previously cited *Harmand 3321* (in herb. Pierre); this is a staminate specimen, and therefore I refer the trinomial, at least as to its Indo-Chinese element but probably excluding the Yünnan specimens, to *K. heteroclita.* Craib, in 1925, cited two Siamese specimens as representing *Schizandra crassifolia,* and I find both of these to fall into *K. heteroclita.*

In the Supplement to the Flore Générale de l'Indo-Chine, Gagnepain has given descriptions and citations (without collectors' numbers) of two entities which I refer to the synonymy of *K. heteroclita.* These are *"Schizandra propinqua"* (the specimen from Tonkin being *Pételot 3762,* cited above) and *"K. peltigera"* (description based on *Poilane 2372,* also cited by me).

The relationship of *K. heteroclita* to *K. longepedunculata* has been discussed above under the latter species. As interpreted in this treatment, *K. heteroclita* has a wider geographical distribution than any other species of the Schisandraceae, but I find no possible means of further dividing this concept.

FIG. 39. Approximate known distribution of *Kadsura heteroclita* from India to Hainan (for other Chinese specimens see *fig. 38;* for Sumatran specimens see *fig. 34*). Detailed data as to localities in Ceylon and the Andaman Islands are not available (see text).

The specimens from India cited above are very unsatisfactory as to detailed localities, and the markings on my distribution map are only approximate, although the Assam distribution is well outlined by Kanjilal et al. (Fl. Assam **1**: 29. 1935). Possibly the only recorded collection of this species from peninsular India is the Wight specimen cited above, from "Malabar" without further data. Gamble (Fl. Pres. Madras **1**: 10. 1935) gives the locality: "forests of the W. Ghâts in Malabar," but I do not know whether or not this refers to the Wight specimen. The available specimens from Ceylon are also without satisfactory detailed localities, and therefore I am unable to show any detailed distribution for the island. Trimen (Hand-book Fl. Ceylon **1**: 16. 1893) records: "Hakgala; Pusselawa;

Hantane; Ambagamuwa"; but none of these places are found on maps available to me. The occurrence of this species in the Andaman Islands, although without specific locality, is indicated by King (in Jour. As. Soc. Beng. **58** (*2*): 376. 1889); such occurrence is to be expected, in view of the existence of the species in Sumatra.

12. **Kadsura** (§ *Eukadsura*) **polysperma** Yang in Contr. Biol. Lab. Sci. Soc. China **12**: 104. *fig. 5.* 1939.

Kadsura sp. Rehder & Wilson in Sargent, Pl. Wils. **1**: 411. 1913.

Apparently dioecious, glabrous throughout, the axillary or subterminal buds ellipsoid, up to 12 mm. long, composed of numerous papyraceous broadly ovate ciliolate bracts; young branchlets brownish or stramineous; 2–5 mm. in diameter, the older ones cinerascent, up to 7 mm. in diameter; bud-scales fugacious, not seen; leaves 5–9 per annual shoot; petioles narrowly winged distally, 12–30 mm. long, 1–1.5 mm. in diameter; leaf-blades subcoriaceous, dark olivaceous above when dried and paler beneath, elliptic-oblong, (6–) 8–12 cm. long, (2–) 3–5.5 cm. broad, obtuse at base, cuspidate to an obtuse apex 3–5 mm. long, entire and narrowly recurved at margin or obscurely and remotely callose-denticulate, densely but minutely yellow-glandular beneath, the costa subplane or impressed above, prominent beneath, the secondary nerves 6–10 per side, subspreading, slightly raised on both surfaces, the veinlet-reticulation prominulous on both surfaces; flowers not known; fruits arising from annual shoots near base, the subtending bracts and pedicellary bracteoles fugacious; fruiting pedicels terete, rugulose, at maturity 35–50 mm. long and 2.5–4 mm. in diameter, the heads subglobose or ellipsoid, 3–4 cm. in diameter (observed) or up to 8 × 6.5 cm. (ex Yang); mature carpels 50–70 (observed) or about 100 (ex Yang, icon.), coriaceous when dried, obovoid, angled by mutual pressure, 10–12 × 6–8 mm. (observed) or 20 × 10 mm. (ex Yang), slightly convex or flattened at apex, the pericarp thicker distally than proximally; seeds 5–7 with some aborting (observed) or 6–11 developing (ex Yang), reniform or ellipsoid, 6–8 × 4–6 mm., the hilar indentation obvious, on long axis (or on short axis in basal seeds), the testa castaneous or brownish, shining.

Type locality: O-mei Shan, Szechuan; type, *C. W. Yao 3312.*

Distribution: Western Szechuan, apparently in a very limited area, at altitudes of 750–1800 m., in thickets or along roadside. See map, *fig. 38.*

CHINA: Szechuan: Ya-chou, *E. H. Wilson 1116* (A); O-mei Shan, *W. P. Fang 2683* (A, K, NY).

Color notes: The cited specimens and the type have fruits which are said to be red or crimson, attaining maturity between August and October.

Unfortunately no flowering material of this species is available. It is apparently a close relative of *K. heteroclita,* differing primarily in having 5–7 (or up to 11, according to the original description) seeds in each fruiting carpel; if some of these seeds are aborted there are distinct remnants. In the fruiting carpels of *K. heteroclita* no more than 5 seeds have been observed, and this is exceptional, the usual number being 2 or 3. One may suspect that foliage differences between this species and *K. heteroclita* also exist, but on the basis of known material these are too intangible to define.

13. **Kadsura** (§ *Eukadsura*) **philippinensis** Elmer in Leafl. Philip. Bot. **1**: 277. 1908; Merr. Enum. Phil. Fl. Pl. **2**: 153. 1923.

Monoecious, or appearing dioecious, glabrous throughout, the larger stems up to 5 cm. thick (ex Elmer), the axillary buds minute; branchlets cinereous or brownish, the younger ones 1–4 mm. in diameter, the older ones up to 6 mm. in diameter; bud-scales several, subcoriaceous, deltoid-ovate, about 1.5 × 2 mm.,

fugacious; leaves 3–11 per annual shoot; petioles narrowly winged distally, 6–16 mm. long, 1–1.5 mm. in diameter; leaf-blades chartaceous, when dried brown on both sides or slightly paler beneath, ovate-elliptic, (5–) 7–10 (–12) cm. long, (2.5–) 3–5 (–6.5) cm. broad, rounded to subacute at base, obtuse or cuspidate with an obtuse apex 2–5 mm. long, entire or obscurely undulate and narrowly recurved at margin, the costa slightly impressed above and prominent beneath, the secondary nerves 5–8 per side, subspreading or subascending, curved, slightly raised on both surfaces, the veinlet-reticulation prominulous on both surfaces; flowers axillary, solitary or paired, the subtending bracts few, papyraceous, broadly deltoid, about 1 × 2 mm., fugacious; ♂ flowers: pedicels at anthesis 8–30 mm. long, slender, 0.8–1 mm. in diameter, with 2 or 3 scattered bracteoles, these oblong, about 1 mm. long, caducous; perianth-segments 12–14, the outer ones thin-coriaceous to submembranaceous, obscurely yellow-glandular, the inner ones slightly thicker, the outermost 2 or 3 orbicular-oblong or ovate-deltoid, 1–3 mm. long and broad, the largest ones broadly elliptic to obovate-oblong, 6–10.5 × 5–8.5 mm., the innermost 3 or 4 reduced, sometimes as small as 3.5 × 2.5 mm.; androecium subglobose or ovoid, at anthesis 3–4 mm. in diameter, the stamens 7–9-seriate, 45–65, the free filaments minute, the connective 0.8–1.2 mm. broad, 0.3–0.5 mm. thick, sparsely yellow-glandular on the flattened apex, the thecae 0.5–0.7 mm. long, the apical stamens slightly reduced; ♀ flowers: pedicels somewhat longer than in ♂, at anthesis (8–) 15–50 mm. long, up to 2 mm. in diameter distally, bracteolate as in ♂; perianth-segments as in ♂; gynoecium subglobose, at anthesis 5–6.5 mm. long and broad; carpels about 5-seriate, 35–50, the ovary obovoid, angled by mutual pressure, coriaceous when dried, at anthesis 1.5–2 mm. long and broad at the flattened apex, the wall slightly the thickest distally, the stigmatic crests submembranaceous, obscurely ciliolate, terminated by a peltate pseudostigma 0.3–0.6 mm. in diameter, proximally extended into an often obvious appendage, the ovules 2–4; fruiting pedicels at maturity 17–65 mm. long, the heads at least 15 mm. in diameter; carpels 30–50, obovoid, 7–8 × 6–7 mm. (perhaps not fully mature), rounded at apex, the pericarp thicker distally than proximally, not flattening to show shape of seeds; seeds 2–4, ellipsoid-flattened, slightly reniform, 4.5–5.2 × 3.5–4 mm., the hilar indentation slight, on long axis, the testa dark brown or dark castaneous.

TYPE LOCALITY: Benguet Province, Luzon; type, *Elmer 8700,* of which a duplicate is cited below.

DISTRIBUTION: Philippine Islands, known from Luzon and Mindanao. See map, *fig. 34.* No altitudinal or habitat data are available, but the species apparently inhabits montane forests.

PHILIPPINE ISLANDS: LUZON: Benguet: Near the barrio of Bacong, 5 miles north of Baguio, *A. D. E. Elmer 8700* (TYPE COLL., A); Sablang, *E. Fénix 12629* (K, US); Rizal: Balacbac, *A. Loher 13000* (A, UC); Laguna: Mt. Banajai, *M. Ocampo 27965* (US). MINDANAO: Bukidnon: Mt. Candoon, *M. Ramos & G. Edaño 38809* (A, K, US); Lanao: Camp Keithley, Lake Lanao, *M. S. Clemens 1145* (A, US); Davao: Todaya, Mt. Apo, *A. D. E. Elmer 11498* (A, Ch, GH, K, M, NY, US).

LOCAL NAMES and COLOR NOTES: From Elmer's field-notes and Merrill's Enumeration the local names are said to be: *Banauwan* (Mindanao, Bagóbo dialect), *Bitokaan* (Luzon, Igorot dialect). The outer perianth-segments are reddish to dark red, the inner ones yellow, and the gynoecium deep red (Elmer's notes). Flowers attain maturity between March and August, and ripe fruits have been collected in November and December.

Although the two Philippine species of § *Eukadsura* maintained in this treatment are not sharply distinct from *K. longepedunculata* and *K. heteroclita,* combinations of more or less reliable characters set them apart, as expressed in my key to species. The relationship of the present species to *K. paucidenticulata* is discussed under the latter, below.

14. **Kadsura** (§ *Eukadsura*) **paucidenticulata** Merr. in Philip. Jour. Sci. Bot. **5**: 176. 1910, Enum. Phil. Fl. Pl. **2**: 153. 1923.

Kadsura Macgregorii Merr. in Philip. Jour. Sci. Bot. **5**: 177. 1910, Enum. Phil. Fl. Pl. **2**: 153. 1923.

Kadsura sorsogonensis Elmer ex Merr. Enum. Phil. Fl. Pl. **2**: 153, as synonym. 1923.

Monoecious or apparently dioecious, glabrous throughout, the axillary buds (sometimes obvious) ellipsoid, up to 6 mm. long, composed of numerous papyraceous oblong ciliolate bracts; younger branchlets purpurascent or brownish, 1.5–3 mm. in diameter, the older ones often cinerascent, up to 5 mm. in diameter; bud-scales few, subcoriaceous, broadly deltoid, obtuse, about 1.5 × 3 mm., fugacious; leaves 3–14 per annual shoot; petioles 6–15 mm. long, 0.6–1 mm. in diameter; leaf-blades chartaceous, when dried dark olivaceous or brownish above and slightly paler beneath, ovate- to obovate-elliptic, (4–) 6–10.5 cm. long, (1.5–) 3–5.5 cm. broad, broadly obtuse at base, cuspidate or short-acuminate with an obtuse apex 3–12 mm. long, serrulate or denticulate at margin at least in the distal half with callose-apiculate teeth about 1 per centimeter (these sometimes obscure), inconspicuously glandular-punctate on both surfaces, the costa slightly impressed above and prominent beneath, the secondary nerves 5–8 per side, subspreading, slightly curved, prominulous above and more obvious beneath, the veinlet-reticulation prominulous on both surfaces; flowers axillary, solitary, the subtending bracts few, subpersistent or caducous, papyraceous, suborbicular to oblong, ciliolate, 1.5–2 mm. long; ♂ flowers: pedicels at anthesis (5–) 11–15 mm. long, 1–1.5 mm. in diameter, with 2 or 3 deltoid-ovate obtuse bracteoles about 1 × 1.2 mm.; perianth-segments 9–12, the outer ones submembranaceous to thin-coriaceous, obscurely yellow-glandular, ciliolate, the inner ones increasingly carnose, scariose-margined but eciliate, the outermost 2–4 deltoid to semiorbicular, 1–3 × 2–4 mm., the largest ones elliptic or obovate-elliptic, 8–10 × 6–8 mm., the innermost 2–5 slightly reduced, thick-carnose, as small as 5 × 3.5 mm.; androecium subglobose, about 4 × 4 mm. at anthesis, the stamens 5- or 6-seriate, 30–33, the free filaments essentially none, the connective about 1.5 mm. broad and 0.5 mm. thick, yellow-glandular, the thecae 0.6–0.7 mm. long; ♀ flowers: pedicels as in the ♂ but at anthesis 10–35 mm. long, the bracteoles 3–5; perianth-segments as in ♂; gynoecium ovoid to subglobose, 3.5–4.5 mm. in diameter at anthesis; carpels about 4-seriate, 25–30, the ovary obovoid or ellipsoid, angled by mutual pressure, at anthesis 1–1.6 × 1–1.3 mm., convex on the broadened apex, the wall nearly uniform in thickness, the stigmatic crests membranaceous, ciliolate, inconspicuous; terminated by a peltate pseudostigma 0.2–0.7 mm. in diameter, proximally often slightly extended into an inconspicuous appendage, the ovules 2 or 3; fruiting pedicels approaching maturity 15–45 mm. long, slender, the heads 10–15 mm. in diameter; carpels 25–30, subglobose-obovoid, about 5 mm. in diameter, the pericarp carnose, essentially uniform in thickness; seeds usually 1 or 2, flattened-subglobose, about 3.5 × 3 mm., the hilar indentation inconspicuous, on longer axis.

TYPE LOCALITY: Benguet Province, Luzon; type, *McGregor 8498*, of which a duplicate is cited below.

DISTRIBUTION: Philippine Islands, thus far known only from Luzon, at recorded altitudes of 2100–2250 m. (but doubtless more variable), in thickets or forests. See map, *fig. 34*.

PHILIPPINE ISLANDS: LUZON: Benguet: *A. Loher 23* (K, US); Mt. Pauai, *R. C. McGregor 8498* (TYPE COLL., K, NY), *E. Quisumbing & M. Sulit 82365* (NY); Baguio, *M. S. Clemens 16454* (UC); Sorsogon: *M. Ramos 23531* (A, Ch, GH, K, M, NY, US); Irosin (Mt. Bulusan), *A. D. E. Elmer 17032* (source of the name *K. sorsogonensis*, A, Ch, GH, M, NY, UC, US).

COLOR NOTES: The outer perianth-segments are said to be red, the inner ones yellow; mature flowers have been obtained in March, June, July, August, and December, and young fruits in August.

SYNONYMY: My reduction of *K. Macgregorii* to synonymy is discussed below. *Elmer 17032*, the source of the name *K. sorsogonensis*, was cited by Merrill as representing *K.*

philippinensis, but I cannot distinguish it from *Ramos 23531*, similarly from Sorsogon Province, and I believe both of these specimens to be better placed in *K. paucidenticulata*.

Merrill (Enum. Phil. Fl. Pl. **2**: 153. 1923) recognizes three Philippine species which fall within my concept of § *Eukadsura*, his own *K. Macgregorii* and *K. paucidenticulata* and Elmer's *K. philippinensis*. The first two of these, in my opinion, are hardly separable; both were described at the same time, and of the two I have seen type material only of *K. paucidenticulata*. However, an available specimen (*Quisumbing & Sulit 82365*) from Mt. Pauai, the type locality of *K. Macgregorii*, is available and agrees excellently with the original description of that species. Merrill distinguishes *K. Macgregorii* from *K. paucidenticulata* "by its axillary, short-pedicelled staminate flowers, and by its pedicels subtended by several, small, imbricated bracts." The fact that the flowers here are axillary rather than "terminal" as in the type of *K. paucidenticulata* seems unimportant; actually in this group of species the flowers are always axillary, sometimes very near the apices of branchlets and sometimes far down the stem. The bracts which subtend the flowers of *K. Macgregorii* (similarly apparent in no. *82365*) are larger and more persistent than those of the type of *K. paucidenticulata;* this is the single character which I can find to separate the two entities as species, and in my opinion it is not of sufficient importance, in view of the variation in the size and persistence of flower-subtending bracts throughout *Kadsura*. In combining these two concepts I retain the binomial *K. paucidenticulata;* possibly no duplicates of the type of *K. Macgregorii* are extant, the actual type doubtless having been destroyed at Manila.

Even reducing the number of Philippine *Eukadsurae* to two does not entirely solve the problem, for *K. paucidenticulata* is not too adequately separable from the earlier *K. philippinensis*. However, distinguishing characters are observable in the foliage, and there is a consistent difference in the number of floral parts, as utilized in my key to species. On the basis of material now available, I retain two Philippine species in § *Eukadsura*, but the validity of these should be reconsidered when more material from the islands becomes available. They may be separated as follows:

Perianth-segments 12–14; stamens 45–65; carpels 35–50; margin of leaf-blades entire or obscurely undulate ..... 13. *K. philippinensis.*

Perianth-segments 9–12; stamens 30–33; carpels 25–30; margin of leaf-blades serrulate or denticulate, at least distally, the teeth callose-apiculate, sometimes obscure. 14. *K. paucidenticulata.*

15. **Kadsura** (§ *Sarcocarpon*) **verrucosa** (Gagnep.) comb. nov.

Schizandra verrucosa Gagnep. in Humbert, Suppl. Fl. Gén. Indo-Chine **1**: 56 (French descr. only). 1938, in Not. Syst. Mus. Nat. Paris **8**: 66. 1939.

Apparently monoecious, glabrous throughout; branchlets robust, cinereous, copiously and conspicuously verrucose-lenticellate, the younger parts 5–6 mm. in diameter, the older parts up to 12 mm. in diameter, the bud-scales fugacious; leaves apparently at least 5 or more on annual shoots; petioles 15–30 (–50) mm. long, 2–2.5 mm. in diameter; leaf-blades coriaceous, when dried dark brown on both surfaces, elliptic-ovate, 13–20 cm. long, 6–10 cm. broad, rounded or subcordate at base and shortly decurrent on the petiole, gradually acuminate with an obtuse apex 10–15 mm. long, entire and narrowly recurved at margin, obscurely glandular beneath, the costa shallowly impressed above, prominent beneath, the secondary nerves 7 or 8 per side, arcuate-ascending, faintly elevated above and strongly raised beneath, the veinlet-reticulation immersed; flowers axillary, solitary or paired, the subtending bracts few, small, fugacious; ♂ flowers:

pedicels subterete, strongly rugulose, 10–20 mm. long at anthesis and 2–2.5 mm. in diameter, with 4–8 scattered bracteoles, these papyraceous, suborbicular-deltoid, obscurely ciliolate, 1–1.5 × about 2 mm.; perianth-segments about 17, several-seriate, the outer ones papyraceous, copiously glandular, obscurely ciliolate, the inner ones carnose to subcoriaceous, often copiously glandular, eciliate, the outermost few bracteole-like, semiorbicular, 2–2.5 × 3–4 mm., the largest ones broadly elliptic, 9–11 × 9–10 mm., with prominent ascending veins, the innermost few reduced, as small as 5 × 4 mm.; androecium obovoid-subglobose, at anthesis 5–7 mm. in diameter, the stamens 4- or 5-seriate, about 30, the connectives sessile, broadly obovoid, angled, 1–1.5 mm. long (high), 1.5–2 mm. broad and thick, flattened and immersed-glandular on the broad apex, the thecae obliquely dorsal-lateral, 0.6–0.9 mm. long; ♀ flowers not seen, but according to Gagnepain with pedicel and perianth-segments similar to the ♂; carpels [ex Gagnep.] globose, 1.5 mm. in diameter, the stigmatic crests apparently terminated by a peltate pseudostigma, the ovules 2.

TYPE LOCALITY: Binh Lu, Tonkin, Indo-China; type, *Poilane 25429*.

DISTRIBUTION: Known only from the type collection, without altitudinal or habitat notes. See map, *fig. 40*.

INDO-CHINA: TONKIN: Binh Lu, prov. Lao Kay, *E. Poilane 25429* (TYPE COLL., A).

COLOR NOTES: Gagnepain notes the perianth-segments as yellowish; the type specimen, in anthesis, was collected March 28, 1936.

Although this species was originally contrasted with *Schisandra crassifolia* Pierre (= *Kadsura heteroclita* at least in part), it clearly represents § *Sarcocarpon* of *Kadsura*, of which section it is the northernmost collection yet known. It is a very distinct species, probably most closely related to *K. scandens*, from which it differs in its strongly verrucose-lenticellate branchlets and its somewhat longer staminate pedicels. The Indo-Chinese species is further characterized by its numerous perianth-segments in the ♂ flower and its comparatively few stamens, the inner segments and the stamens being unusually thick in texture. Gagnepain's descriptions take up only the ♀ flowers, but my sheet of the type collection has ♂ flowers; two undissected flowers on this sheet may be ♀, as the original description indicates that these are similar to the ♂ in perianth-characters.

16. **Kadsura** (§ *Sarcocarpon*) **marmorata** (E. G. & A. Henderson) comb. nov.

Sphaerostema marmoratum E. G. & A. Henderson, Ill. Bouquet **2**: *pl. 40*. 1859–61; Groenland in Rev. Hort. **1862**: *229. fig. 24*. 1862.

Schizandra marmorata Hemsl. in Garden **8**: 271. 1875; Hassack in Bot. Centralbl. **28**: 245. 1886; Nichols. Ill. Dict. Gard. **3**: 383. 1887.

Sphaerostema marmorata Hort. ex Morren & de Vos, Ind. Bibl. Hort. Belg. 437. 1887.

Kadsura scandens sensu Merr. in Philip. Jour. Sci. Bot. **2**: 422. 1907, Bibl. Enum. Born. Pl. 251, p. p. 1921, Enum. Phil. Fl. Pl. **2**: 153. 1923; non Bl.

Kadsura apoensis Elmer in Leafl. Philip. Bot. **8**: 2748. 1915; Merr. Enum. Phil. Fl. Pl. **2**: 153. 1923, in Univ. Cal. Publ. Bot. **15**: 60. 1929.

Kadsura sulphurea Elmer in Leafl. Philip. Bot. **8**: 2750. 1915.

Monoecious or apparently dioecious, glabrous throughout; branchlets stout, when young purpurascent to stramineous, 2–6 mm. in diameter, the older ones often cinerascent, up to 10 mm. or more in diameter; bud-scales several, subcoriaceous, broadly deltoid, rounded, 2–5 × 3–7 mm., caducous; leaves 3–10 per annual shoot, sometimes subpersistent; petioles 15–40 (–60) mm. long, very stout, 2–4 mm. in diameter; leaf-blades coriaceous or subcoriaceous, when dried olivaceous to dark brown on both surfaces, sometimes with faint indications of large irregular blotches of paler color, broadly ovate or ovate-elliptic, (9–) 10–24 cm. long, (4.5–) 6–17.5 cm. broad, lightly cordate to broadly obtuse at base and short-decurrent on the petiole, obtuse to short-cuspidate and sometimes slightly

thickened at apex, entire and narrowly recurved at margin or remotely and obtusely callose-denticulate, sometimes densely yellow-glandular beneath, the costa shallowly or deeply impressed above, prominent beneath, the principal secondary nerves 5–10 per side, proximally subspreading, distally subascending, slightly curved, plane or faintly raised above or rarely impressed, strongly elevated or prominent beneath, copiously anastomosing toward margin, the veinlet-reticulation usually fairly intricate and prominulous on both surfaces, sometimes subimmersed; flowers axillary, solitary, the subtending bracts few, subcoriaceous, deltoid or suborbicular, 1.5–3 × 1.5–4 mm., ciliolate, subacute or rounded, caducous; ♂ flowers: pedicels rugulose, at anthesis 2–7 mm. long and about 1.5 mm. in diameter, with 3–8 scattered bracteoles, these papyraceous, deltoid, obtuse, 1–2.5 × 1.5–3 mm.; perianth-segments 15–20, several-seriate, the outer ones papyraceous and ciliolate, the inner ones increasingly carnose, minutely yellow-glandular, eciliate, the outermost 3–5 bracteole-like, 2–3 × 2–5 mm., the largest ones oblong or elliptic-oblong, 13–20 × 7–11 mm., the innermost few narrowed, as small as 10 × 4 mm.; androecium subglobose-ovoid, at anthesis 7–8 mm. in diameter, the stamens irregularly 5–7-seriate, 38–50, the free filaments short or essentially none, the connective irregularly oblong-obovoid, about 1 mm. long (high) and 1–1.5 mm. broad and thick, flattened on the irregular apex, the thecae obliquely submersed, obovoid-oblong, 0.6–0.8 mm. long, separated by the broad dorsal angle of the connective; ♀ flowers: pedicels at anthesis 5–15 mm. long and 2–3.5 mm. in diameter, bracteolate as the ♂; perianth-segments as in ♂; gynoecium ovoid, at anthesis about 8 × 6–7 mm., the column stout, subcoriaceous, clavate; carpels very numerous, 250–300 (in indigenous specimens, perhaps only about 60 in cultivated material), 12–18-seriate (in indigenous material), oblong-obovoid or obovoid-clavate, angled by mutual pressure, at anthesis 1–2 mm. long and 1–1.2 mm. broad, convex or rounded at apex, the wall copiously yellow-glandular, thick-carnose distally, thinner to papyraceous toward base, the stigmatic crests carnose, ciliate, fused into a columnar angled mass along ventral margin of carpel, projecting into a peltate pseudostigma up to 1 mm. in diameter, proximally inconspicuous or linear-appendiculate, the locule basal, the ovules 2; fruiting pedicels rugulose, at maturity up to 25 mm. long and 2–6 mm. in diameter, the bracteoles often subpersistent, the heads ellipsoid, up to 13 × 11 cm., the torus coriaceous, clavate- or oblong-ellipsoid, pitted at bases of carpels, up to 5 × 1.5 cm.; mature carpels very numerous, up to 300, coriaceous, narrowly clavate or oblong-ellipsoid, at maturity 28–40 mm. long and 7–10 mm. broad distally, narrowed at base, rounded at apex and greatly thickened, the pericarp carnose when fresh, drying very coriaceous and solid, the locule basal; seeds 1 or 2, reniform-cordiform, 7–10 mm. long, 5–7 mm. broad, the hilar indentation obvious or inconspicuous, the testa dark castaneous. FIG. 41, f–k.

TYPE LOCALITY: A cultivated plant, originally introduced from Mt. Kinabalu, Borneo, was the type of *Sphaerostema marmoratum;* the origin of this plant is further discussed below.

DISTRIBUTION: Southern Philippine Islands (Palawan and Mindanao) and British North Borneo, at recorded altitudes of 75–1500 m. See map, *fig. 40.* Reported habitats include woods, thickets, stream-banks, or forested flats.

PHILIPPINE ISLANDS: PALAWAN: Mt. Capoas, *E. D. Merrill 9504* (K, NY, US). MINDANAO: Agusan: Cabadbaran, Mt. Urdaneta, *A. D. E. Elmer 13505* (type coll. of *K. sulphurea,* A, Ch, GH, K, M, NY, UC); Bukidnon: Mahilucot River, *M. Ramos & G. Edaño 38640* (K, US); Lanao: Camp Keithley, Lake Lanao, *M. S. Clemens 683* (A, Ch, US); Davao: Along Mainit Creek, toward Sibulan River, Todaya, Mt. Apo, *A. D. E. Elmer 11718* (type coll. of *K. apoensis,* A, Ch, GH, K, M, NY).

BORNEO: BRITISH NORTH BORNEO: Lobang, Mt. Kinabalu, *M. S. Clemens 10394* (A, K, Man, UC); Dallas, Mt. Kinabalu, *J. & M. S. Clemens 26235* (K), *29250* (A, K, UC), *36896* (K); Tenompok, Mt. Kinabalu, *J. & M. S. Clemens 28522 = 28803* (A, UC), *29354* (A, K, UC); Tawao, Elphinstone Province, *A. D. E. Elmer 21696* (A, Ch, GH, K, M, NY, UC).

CULTIVATED: Hort. Kew, Jan. 11, 1886 (K) (Kew Gardens; descendant of TYPE-plant?).

LOCAL NAMES and COLOR NOTES: Elmer records the following names from Mindanao: *Canogon* or *Kanogon* (Manóbo dialect), *Lomabag* (Bagóbo dialect). The flowers are said to be yellowish or cream-green, but in one case Elmer remarks that the perianth-segments are bright red except on the greenish exposed outer surfaces, the gynoecium being reddish. The fruit is dull yellowish when ripe, or green, with the inner sides of the carpels deep red. Seasons are not sharply marked; mature flowers have been obtained in April as well as from August to October, while ripe fruits were collected from August to November and also in February and April.

SYNONYMY: A cultivated plant, passing under the names *Sphaerostema marmoratum* or *Schizandra marmorata,* has been mentioned in literature several times and illustrated at least twice, as noted in the above synonymy. In what appears to be the earliest mention of the plant, E. G. & A. Henderson, in their "Illustrated Bouquet," discuss and illustrate (in color) a sterile plant with "large, firm leathery, acuminately heart-shaped leaves . . . marked throughout with numerous silvery-white fleece-like spots or clouds, . . ." Of this plant they say: "We are indebted for its introduction to the enterprise of Hugh Low, Jun., Esq., by whom it was discovered during an expedition to the Kina Baloo Mountain, in Borneo, . . ." All subsequent discussions of the plant are similarly based upon sterile material, and all emphasize the mottled or "marbled" appearance of the leaves.

No species of *Schisandra* are known from Borneo, but four species of *Kadsura* occur there, three of them being known from Mt. Kinabalu. The descriptions and illustrations of the cultivated plant strongly suggest, in their foliage, the well-known *K. apoensis* Elmer, except that no collector has noted the leaves of that species as mottled. However, several of the available herbarium specimens of *K. apoensis* have leaves which show a certain amount of irregular blotching; I should not necessarily assume that the living plants had this characteristic, but possibly it will prove specific in nature.

On the basis of the facts brought out above I had suspected the identity of *Sphaerostema marmoratum* with *Kadsura apoensis;* but grounds for replacing the later name did not seem adequate. Fortunately, however, a specimen loaned me from Kew is indicated as: "Kew Gardens, Jan. 11, 1886. Cultivated as *Schizandra marmorata.*" This specimen agrees perfectly with the Hendersons' plate and illustration, and I have no doubt that it was taken from a descendant of their plant, possibly the plant upon which Hemsley's mention is based. In their dried condition, the leaves of this specimen appear no more mottled or blotched than do the dried leaves of the indigenous Bornean plant. The cultivated Kew specimen is accompanied by ♀ flowers collected slightly after anthesis, indicating that the entity did flower in cultivation at least once. In one respect only does this specimen differ from material of *K. apoensis:* its flowers appear to have about 60 carpels, whereas the ♀ flowers of indigenous material, as far as these are available, are characterized by an extraordinarily large number of carpels, usually 250–300. The carpels of this species are quite characteristic, not only in their number, but also in their stout stigmatic crests, which are surmounted by a subpeltate pseudostigma, and in the extreme distal thickening of the ovary wall. In these important characters the carpels of the cultivated specimen agree with those of indigenous material. It seems quite possible that the material brought from Mt. Kinabalu by Low became modified, in respect to number of carpels, as a result of its greenhouse culture. Since in all other respects the cultivated material is essentially identical with *K. apoensis,* I propose to replace this binomial by the new combination based on *Sphaerostema marmoratum.*

The references to *K. scandens* listed above are based upon such specimens as *Clemens 683* and *10394,* which certainly represent the present entity. The type collection of *K. apoensis* is *Elmer 11718,* from Mindanao, a specimen with ♀ flowers which is surely conspecific with the material from Mt. Kinabalu. *Kadsura sulphurea* is typified by *Elmer 13505,* also from Mindanao, a monoecious specimen with both ♂ and ♀ flowers. I have no hesitation in agreeing with Merrill (Enum. Phil. Fl. Pl. **2**: 153. 1923) that the Mindanao plants are conspecific; in combining these two concepts Merrill selected the binomial *K. apoensis,* since both of Elmer's species were published at the same time.

Kadsura marmorata is a remarkably distinct species, characterized not only by the large and frequently subcordate leaf-blades and the extremely numerous carpels, as mentioned above, but also by the long and proportionately narrow perianth-segments, the short pedicels, and the very stout columnar ridge formed by the

fused stigmatic crests of the carpel. This species is thus readily separated from its closest ally, *K. scandens*.

17. **Kadsura** (§ *Sarcocarpon*) **scandens** (Bl.) Bl. Fl. Jav. [Schizandr.] 9. *tab. 1.* 1830; Walp. Rep. Bot. Syst. **1:** 92. 1842; Dietr. Syn. Pl. **3:** 307. 1842; Hassk. Cat. Pl. Hort. Bot. Bog. 177. 1844; Hook. f. & Thoms. Fl. Ind. **1:** 84. 1855; Miq. Fl. Ned. Ind. **1** (*2*)**:** 19. 1858; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. **1:** 45. 1872; King in Jour. As. Soc. Beng. **58:** 375. 1889, in Ann. Bot. Gard. Calcutta **3:** 221. *pl. 71.* 1891; Backer, Schoolfl. voor Java 17. 1911; Koorders, Exkursionsfl. Java **2:** 242. *fig. 50.* 1912; Ridley, Fl. Malay Penins. **1:** 20. *fig. 5.* 1922; Merr. in Contr. Arnold Arb. **8:** 57. 1934; Burkill, Dict. Econ. Prod. Malay Penins. 1275. 1935.

Sarcocarpon scandens Bl. Bijdr. Fl. Ned. Ind. 21. 1825; Spreng. Syst. Veg. **4** (*2*)**:** 217. 1827.

Kadsura cauliflora Bl. Fl. Jav. [Schizandr.] 11. *tab. 2.* 1830; Walp. Rep. Bot. Syst. **1:** 92. 1842; Dietr. Syn. Pl. **3:** 307. 1843; Schnizl. Iconogr. **3:** *pl. 175, fig. 18–20.* 1843–70; Miq. Fl. Ned. Ind. **1** (*2*)**:** 19. 1858; King in Jour. As. Soc. Beng. **58:** 375. 1889, in Ann. Bot. Gard. Calcutta **3:** *222. pl. 72.* 1891; Schimper, Pfl.-Geogr. 361. *fig. 182.* 1898; Backer, Schoolfl. voor Java 17. 1911; Ridley, Fl. Malay Penins. **1:** 20. 1922; Craib, Fl. Siam. Enum. **1:** 28. 1925; Burkill, Dict. Econ. Prod. Mal. Penins. 1275. 1935.

Sarcocarpum scandens Bl. ex G. Don, Gen. Syst. **1:** 101. 1831.

Kadsura scandens α *normalis* Kuntze, Rev. Gen. Pl. **1:** 6. 1891.

Kadsura scandens β *intermedia* Kuntze, Rev. Gen. Pl. **1:** 6. 1891.

Kadsura scandens γ *cauliflora* Kuntze, Rev. Gen. Pl. **1:** 6. 1891.

Schizandra axillaris sensu Kuntze, Rev. Gen. Pl. **1:** 6. 1891; non Hook. f. & Thoms.

Schizandra ovalifolia Parment. in Bull. Sci. Fr. & Belg. **27:** 237, 312. 1896.

Kadsura Wallichii Korth. ex Koorders, Exkursionsfl. Java **2:** 242, as synonym. 1912.

Apparently dioecious but possibly sometimes monoecious, glabrous throughout, the main stems to 2 cm. in diameter, with deeply furrowed corky bark; branchlets elongate, when young usually purpurascent, 2–4 mm. in diameter, the older ones often cinerascent, up to 15 mm. in diameter; bud-scales several but early fugacious; leaves usually 6–12 per annual shoot, sometimes persisting for more than one growing season; petioles 10–45 mm. long, stout, 1–3 mm. in diameter; leaf-blades coriaceous or subcoriaceous, when dried dark brown or dark olivaceous on both surfaces, oblong- or ovate-elliptic or broadly ovate, (6–) 9–17 cm. long, (2.5–) 4–10 cm. broad, often up to 23 × 15 cm. toward basal part of plant, broadly obtuse or rounded or subcordate at base (on young leaves sometimes acute), cuspidate to acuminate with an obtuse apex 5–20 mm. long, entire and narrowly recurved at margin, sometimes pale-glandular beneath, the costa often deeply impressed above and prominent beneath, the secondary nerves 4–7 per side, subspreading or subascending, curved, slightly raised or impressed above, strongly raised beneath, the veinlet-reticulation usually not intricate, faintly prominulous or immersed on both sides; flowers axillary and solitary or in glomerules of 2 or 3 or arising from main branchlets in irregular several-flowered glomerules, each subtended by a few papyraceous or subcoriaceous bracts, these broadly deltoid, 1–2 × 2–3 mm., obtuse, caducous; ♂ flowers: pedicels rugulose, at anthesis 6–15 mm. long and 0.7–1.5 mm. in diameter, with 2–4 scattered bracteoles, these papyraceous, ovate-deltoid, obtuse, ciliolate, 1–2 × 1–3 mm.; perianth-segments 10–17, several-seriate, the outer ones papyraceous to submembranaceous, often obscurely pellucid-glandular and ciliolate, the inner ones increasingly carnose, sometimes obviously nerved and yellow-glandular, eciliate, the outermost 2 or 3 broadly ovate or oblong-deltoid, rounded, 1.5–5 × 2–4 mm., the largest ones elliptic or obovate-elliptic, 8–17 × 5.5–15 mm., the innermost few reduced to 5–10 × 3–7 mm.; androecium subglobose or subovoid, at anthesis 5–7 mm. in diameter, the column about 1.5 mm. in diameter at base, the stamens 4–6-seriate, 22–65, the free filaments none or minute, the connective irregularly oblong-turbinate or obovoid,

angled by mutual pressure, sometimes copiously yellow-glandular, 0.8–1.5 mm. long (high), 0.8–2 mm. broad and thick on the flattened subpentagonal apex, the thecae ellipsoid-oblong, 0.6–1.1 mm. long, sometimes contiguous at base; ♀ flowers: pedicels 11–60 mm. long at anthesis and 1.2–2 mm. in diameter, bracteolate as the ♂ or with 5–10 bracteoles; perianth-segments 11–24, as in ♂; gynoecium subglobose-ellipsoid or subovoid, at anthesis 5–10 mm. in diameter, the column coriaceous, obovoid; carpels 60–120, 5–9-seriate, ovoid- to obovoid-ellipsoid, rounded or flattened at apex, at anthesis 1.2–2.5 × 0.6–1.3 mm., the wall thick-carnose, thicker distally than proximally, the stigmatic crests subcarnose, 0.2–0.5 mm. broad, distally conspicuous and flaring into a pseudostigma, this peltate or sometimes deeply bifid, 0.5–1.5 mm. in diameter, often erosulous, the proximal extension of the crests none or up to 0.5 mm. long, the ovules 2; fruiting pedicels rugulose, at maturity 30–70 mm. long and 2–5 mm. in diameter, with sometimes persistent bracteoles, the heads ellipsoid, up to 7 × 5 cm. (largest observed), the torus coriaceous, ellipsoid, up to 2.5 × 2 cm., pitted at bases of carpels; mature carpels 40–120, obovoid-turbinate, up to 25 × 15 mm. (largest observed), narrowed at base, rounded or subtruncate at apex, the pericarp drying coriaceous, much thicker distally than toward base, the locule basal; seeds 1 or 2 ellipsoid or flattened subglobose, 6–9 mm. long, 4–6 mm. broad, the hilar indentation obvious or slight, on short axis of upper margin of seed (sometimes on long axis of a ventrally attached upper seed), the testa castaneous.

TYPE LOCALITY: Mt. Gede–Mt. Pangrango region, Java; a duplicate of the type, collected by Blume, is cited below.

DISTRIBUTION: Southern Siam through Malay Peninsula and Sumatra to Java, at altitudes variously recorded between 100 and 1950 m. See map, *fig. 40.* The usually noted habitat is either forest or dense jungle.

SIAM: NAKAWN SRITAMARAT: No material seen, but cited from Kao Ram, *E. Smith 620,* by Craib in 1925.

MALAY PENINSULA: PENANG: Government Hill, *C. Curtis 1529* (K), *2440* (K). PERAK: *B. Scortechini 1869* (K), *1969* (K); Larut Hills, King's collector [*H. Kunstler?*] *3507* (K), *3785* (US). SELANGOR: Kanching Reserve, *E. J. Stengnell 13956* (K). MALACCA: *W. Griffith* (K), *74* (K). SINGAPORE: Bajan, *H. N. Ridley 6242* (K); Bukit Timah, *M. Nur 26103* (K).

SUMATRA: GOUVT. ATJEH: Takingeun, *W. N. & C. M. Bangham 703* (A, K, NY), *705* (A, NY). GOUVT. OOSTKUST: Vicinity of Loemban Ria, Asahan, *Rahmat Si Boeea 7605* (A, US). RES. SUMATRA'S WESTKUST: Goenoeng Singgalang, *O. Beccari 320* (K); "Ad Ayer mancior (Ajer mantgoer)," Prov. Padang, *O. Beccari 667* (type coll. of *Schizandra ovalifolia,* K); Sipora (Sakobaoe) Island, *C. Boden-Kloss 14709* (K). RES. BENKOELEN: Boekit Kaba, *H. O. Forbes 2882* (K). RES. LAMPOENGSCHE DISTR.: *H. O. Forbes 1400* (K). Sumatra, without detailed locality, *D. Fairchild 1044* (UC).

JAVA: *F. Junghuhn 184* (K); "Java occ.," Herb. Hort. Bot. Bog. (coll. *Arsin*) 19665 (K); Kandang Badak to Tjibeureum, *H. S. Yates 2881* (NY, UC); "southeast Java," *H. O. Forbes 801a* (GH). WEST-JAVA: Tjiapoes, Buitenzorg, *H. Hallier 751* (NY); Mt. Gede and Mt. Pangrango, *C. L. Blume* (TYPE COLL., K, NY); Mt. Gede, *O. Kuntze 4700* (NY), *J. & M. S. Clemens 30381* (NY); Mt. Boerangrang, *C. L. Blume* (type coll. of *K. cauliflora,* K); Sagaranten-Rambai, *O. Kuntze 5210* (NY type of *K. scandens* var. *intermedia*); "Preanger," *H. O. Forbes 800a* (K).

LOCAL NAMES and USES: In Malay Peninsula: *Akar Kapala Patong, Akar Dama Daura* (Ridley); *Akar dama-dama, Kepala patong* (puppet's head), *Kerukol akar, Belebar, Belewar, Hunyur buut* (Sundanese), *Wèra aroi* (Sundanese) (Burkill). In Sumatra: *Andor sidari* (Rahmat Si Boeea). In Java: *Aroy Hungur-bu-ut, Hun-gun Bu-ut* (Blume); *Aroy hoenjoer bocoet* (Hasskarl); *Honje buut* (Koorders); *Akar damak-damak, Akar tjalak, Areuj bocoet, Areuj hoemboet, Areuj hoenjoer bocoet* (Backer). Burkill notes that the fruit is edible but is somewhat astringent; it is sold in some markets in Sumatra. The juice is used for coughs and dysentery in the Netherlands Indies, and a decoction of the roots is used for rheumatism in the Malay Peninsula, also according to Burkill.

COLOR NOTES: The perianth-segments are red, and mature fruits are usually reported to be scarlet, shading to bronze or yellow. Flowers at anthesis have been collected in nearly

every month of the year, but the only dated mature fruits available were obtained either in January or in June and July.

SYNONYMY: A difference of opinion as to the value of Blume's two binomials *K. scandens* and *K. cauliflora* is apparent in the literature. Both names are based on types from Java, of which duplicates are cited above; unfortunately the available type collections are sterile, but Blume's descriptions and plates are excellent. The available type duplicates are quite identical in foliage, and indeed Blume did not utilize leaf-characters to distinguish his *K. cauliflora,* of which he says: "Est *K. scandenti* quam maxime assimilis, at dignoscitur pedunculis florum femineorum multo longioribus, petalis numerosioribus, carpellisque minoribus neque in acumen uncinatum desinentibus." Whether flowers and fruits are borne on the young or old branchlets or even on the main stems is, in my observation, inconsequential in this complex. As to variation in number of parts, this will be commented upon below. Blume's observation of the termination of the carpel in *K. cauliflora,* as shown in his original plate, *figs. 5, 6,* is fairly accurate for Javanese and Sumatran specimens, although there is some variation in the shape of the pseudostigma in the present species. In short, I find no noteworthy differences between *K. scandens* and *K. cauliflora.*

Kuntze proposed three varieties under *K. scandens,* one based on the type, one based on *K. cauliflora,* and a third, var. *intermedia,* described as new. The type of the new variety, from Java, cited above, is a wretched specimen consisting of a length of stem and a few old flower-fragments; this variety has nothing to recommend its maintenance. Kuntze's reference to a specimen from Mt. Gede as *Schizandra axillaris* probably refers to his no. *4700,* cited above, which is obviously *K. scandens.*

Schizandra ovalifolia Parment., although inadequately described, must be considered validly published since it is accompanied by citation of a type, *Beccari 667,* from Sumatra. Fortunately I have seen a duplicate of this collection, with excellent ♀ flowers, cited above, which falls into my concept of *K. scandens.*

Kadsura Wallichii has apparently been mentioned in literature only once, by Koorders as a synonym of *K. scandens,* without indication of the source of the name.

Most authors who have attempted to retain two species in the present complex have utilized such characters as leaf-shape and position of flowers. As to the latter character, examination of a series of specimens shows that the flowers may be either axillary and solitary toward the branchlet-apices, or in glomerules of 2 or 3, or in irregular several-flowered glomerules arising far down the stems. On specimens otherwise identical these various flowering habits are observed, indicating that factors other than genetic are involved. As to leaf-shape and -size, I am convinced that the position of the leaves on the plant causes the observed variation. Leaves toward the apices of branchlets, presumably from the higher parts of the vines, are comparatively small and have the bases usually acute; leaves from lower parts of the vines are larger and more coriaceous, with frequently subcordate bases. In general, the available specimens from the Malay Peninsula and Sumatra have coarser leaves than those from Java, but one may suspect this to be purely coincidental among the observed specimens.

Variation in number of parts, concomitant with geographical distribution, has been observed as follows: stamens in the Malay Peninsula are 50–65, in Sumatra about 35, in Java 20–40; perianth-segments in ♀ flowers in the Malay Peninsula are 11 or 12, in Sumatra 19–24, in Java 18 or 19; carpels in the Malay Peninsula are 90–120, in Sumatra 60–75, and in Java about 60. Unfortunately the available material is not sufficiently ample or good to permit careful checking of this variation; for the time being I am inclined to ascribe it to chance.

To summarize, the total variation among the cited specimens is not so great as to indicate the necessity for more than one nomenclatural unit. The closest allies of *K. scandens, K. marmorata* and the new *K. celebica,* have comparatively tangible characters as well as discrete geographical distribution to recommend them.

18. **Kadsura** (§ *Sarcocarpon*) **celebica** sp. nov.

Planta monoica ubique glabra, ramulis hornotinis purpurascentibus 2–4 mm. diametro, annotinis cinerascentibus ad 6 mm. diametro; squamis basi ramulorum hornotinorum pluribus subcoriaceis late deltoideis subacutis ad 3 × 5 mm. fugacibus; foliis pluribus per ramulum hornotinum interdum subpersistentibus; petiolis 10–15 mm. longis 1–2 mm. diametro; laminis coriaceis in sicco utrinque fusco-brunneis, ovato-ellipticis, 8–14 cm. longis, 5–9.5 cm. latis, basi rotundatis vel paullo subcordatis, apice obtuse breviterque cuspidatis, margine integris et incon-

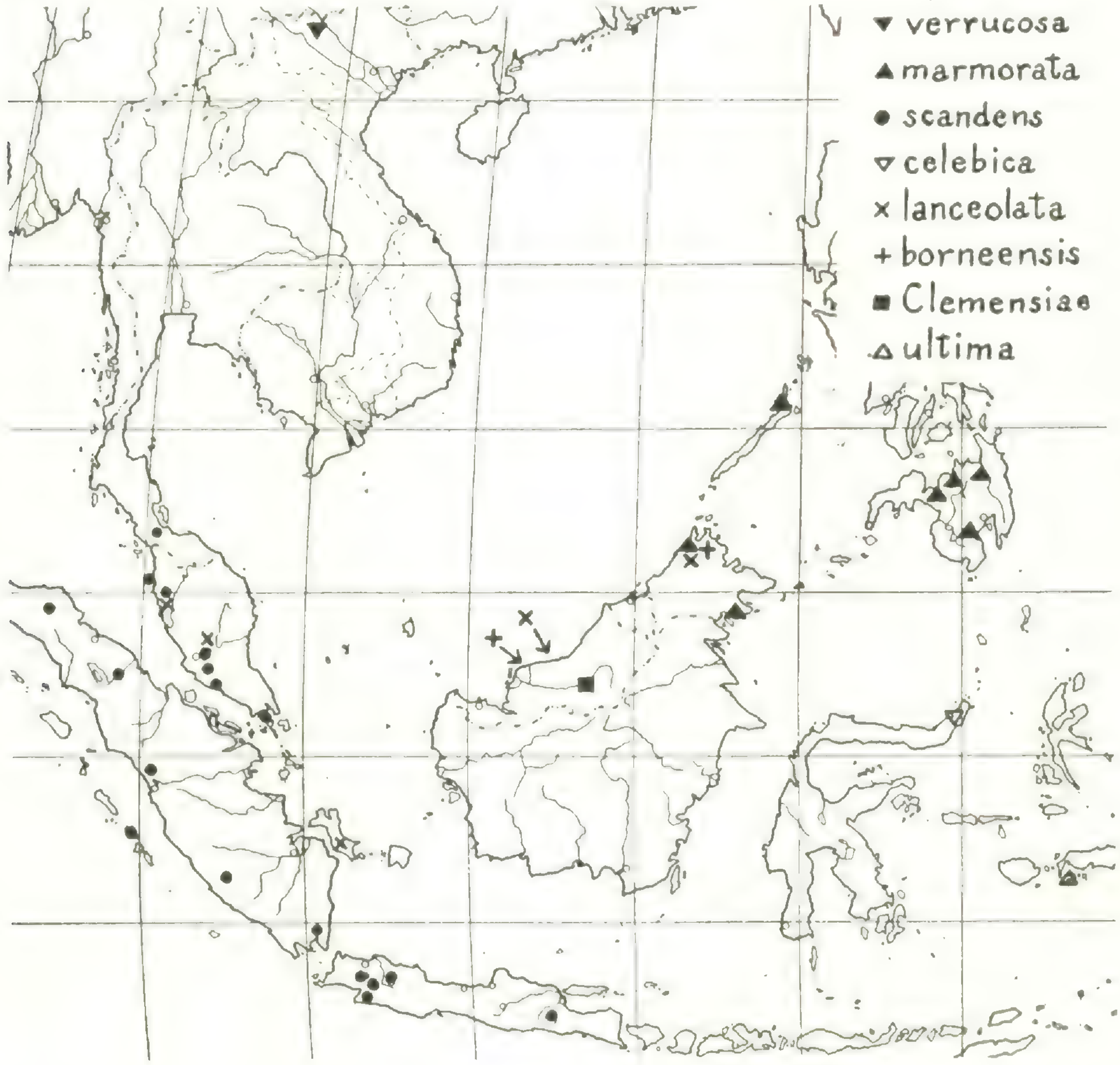

FIG. 40. Approximate known distribution of *Kadsura verrucosa, K. marmorata, K. scandens, K. celebica, K. lanceolata, K. borneensis, K. Clemensiae*, and *K. ultima*. *Kadsura lanceolata* and *K. borneensis* have been obtained in Sarawak without exact locality.

spicue recurvatis, subtus minute luteo-glandulosis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 5 vel 6 arcuato-patentibus supra haud prominulis subtus valde elevatis, rete venularum utrinque inconspicue prominulo vel supra immerso; floribus axillaribus solitariis vel e glomerulis 2 vel 3 enatis, ♂ et ♀ interdum mixtis, bracteis basalibus pluribus papyraceis suborbicularibus ciliolatis circiter 1 × 2 mm.; floribus ♂: pedicellis sub anthesi 10–15 mm. longis et 1.5 mm. diametro, bracteolis 1 vel 2 papyraceis oblongis circiter 1.5 × 1 mm.; segmentis perianthii circiter 12, exterioribus papyraceis obscure ciliolatis, interioribus carnosis eciliatis, extimis 2 vel 3 late ovatis 2–3 × 2.5–5 mm., maximis

suborbiculari-ellipticis, 8–11 × 7–9 mm., intimis ad 9 × 4 mm. reductis; androecio subgloboso sub anthesi circiter 6 mm. diametro, staminibus 3- vel 4-seriatis circiter 35 circiter 2 mm. longis (altis), filamentis liberis subnullis, connectivo obovoideo obscure luteo-glanduloso circiter 2 mm. lato et crasso, apice irregulariter pentagono, thecis ellipsoideis circiter 1 mm. longis oblique dorsali-lateralibus angulo dorsali obtuso connectivi disjunctis; floribus ♀: pedicellis ut ♂ sed sub anthesi 13–20 mm. longis ad 2 mm. diametro; segmentis perianthii ut ♂ sed 13–17, maximis 13–16 × 8–12 mm.; gynoecio depresso-subgloboso sub anthesi circiter 7 × 9 mm., columna subglobosa; carpellis circiter 4-seriatis, 35–40, ovario ellipsoideo vel falcato-ovoideo sub anthesi 2.5–3 × 1.2–1.5 mm., cristis stigmatiferis prominentibus subcarnosis erosulis 0.5–0.7 mm. latis distaliter in pseudostigma irregulare vel subpeltatum 1–2 mm. diametro productis, basi truncatis vel haud appendiculatis, loculo subbasali, ovulis 2 ex angulo ventrali pendulis, ovarii pariete superne obvie incrassato. FIG. 41, b–e.

TYPE LOCALITY: Tomohon, northeastern Celebes; type, *Sarasin 584*.

DISTRIBUTION: Known only from the type collection, without altitudinal or habitat data. See map, *fig. 40*.

CELEBES: RES. MANADO: Tomohon, Minahasa, *F. & P. Sarasin 584* (K TYPE), Oct. 1894.

Although the specimen described above is so closely allied to *K. scandens* that, in view of the variation already permitted by me in Blume's species, its proposal as new may seem ill-advised, nevertheless I prefer not to extend the known distribution of *K. scandens* as far east as Celebes, since all the material from the intervening Borneo clearly belongs to other species. Furthermore, the Sarasin specimen falls outside of the extreme variation of *K. scandens* in its reduced number of carpels and its extremely large stamens, while its leaf-blades are not precisely matched in shape in the western species.

19. **Kadsura** (§ *Sarcocarpon*) **lanceolata** King in Jour. As. Soc. Beng. **58**: 376. 1889, in Ann. Bot. Gard. Calcutta **3**: 223. *pl. 73, B.* 1891; Ridley, Fl. Malay Penins. **1**: 21. 1922.

Kadsura scandens sensu Ridley in Sarawak Mus. Jour. **1** (3): 72. 1913; Merr. Bibl. Enum. Born. Pl. 251, p. p. 1921; non Bl.

Apparently dioecious but possibly sometimes monoecious, glabrous throughout; branchlets slender, when young purpurascent or stramineous, 1–2.5 mm. in diameter, the older ones cinerascent or brownish, up to 6 mm. in diameter; budscales few, subcoriaceous, broadly deltoid, about 1 × 2–3 mm., fugacious; leaves 4–10 per annual shoot; petioles 5–18 mm. long, 1–2 mm. in diameter; leaf-blades subcoriaceous, when dried dark brown or dark olivaceous and concolorous, oblong- or lanceolate- or ovate-elliptic, 6–11 cm. long, 3–5.3 cm. broad, broadly obtuse to subacute at base, short-acuminate with an obtuse apex 5–12 mm. long, entire and narrowly recurved at margin, usually copiously pale-glandular beneath, the costa impressed above and prominent beneath, the principal secondary nerves 5–7 per side, spreading-arcuate, slightly raised on both surfaces or more pronounced beneath, the veinlet-reticulation sometimes intricate and prominulous on both sides, sometimes obscure or immersed; flowers solitary, axillary or arising from branchlets below leaves, subtended by a few minute bracts, these papyraceous, deltoid, 0.5–1 × 1–2 mm.; ♂ flowers: pedicels slender, rugulose, at anthesis 2–18 (rarely to 37) mm. long and 0.7–1.2 mm. in diameter, with 1–4 scattered bracteoles, these papyraceous, broadly ovate or deltoid, 0.5–1.5 × 1–1.8 mm.; perianth-segments 8–14, the outer ones papyraceous, obscurely pellucid-glandular and ciliolate, the inner ones thin-carnose, sometimes eglandular, eciliate, the outermost 2 or 3 suborbicular, 1–3.5 × 1.5–4 mm., the largest ones elliptic to obovate-suborbicular, 6.5–9 × 5–8 mm., the innermost few reduced, sometimes as small as 4 × 2.5 mm.; androecium subglobose, at anthesis 4–5.5 mm. in diameter, the stamens 4-

or 5-seriate, 23–45, the free filaments minute, the connective obovoid, irregularly angled by mutual pressure, 0.8–1 mm. long (high), 1–1.7 mm. broad and thick at the irregularly pentagonal flattened apex, the thecae obliquely ellipsoid, 0.5–0.7 mm. long; ♀ flowers: pedicels as in ♂; perianth-segments as in ♂ but the largest ones observed up to 11 × 8.5 mm.; gynoecium ovoid-subglobose, at anthesis about 5 × 5 mm., the carpels 3–5-seriate, 20–50, ellipsoid or obovoid-oblong, angled by mutual pressure, at anthesis 1–2 mm. long and broad, convex and obscurely glandular at apex, the wall slightly the thickest distally, the stigmatic crests obvious, submembranaceous, distally produced into a linear pseudostyle 0.1–0.5 mm. long, with minute proximal appendages, the ovules *2*; fruiting pedicels not much enlarged, with sometimes persistent bracteoles, the heads subglobose, at least 1.5 cm. in diameter (perhaps not fully mature), the torus coriaceous, subclavate; carpels approaching maturity apparently up to 40, obovoid to turbinate, up to 8 × 6 mm. (largest seen), rounded at apex, with a sometimes persistent pseudostyle, the pericarp carnose, slightly thicker distally than proximally or nearly uniform in thickness; seeds 2 (sometimes 1), irregularly subglobose-reniform, laterally flattened, 3.5–4.5 mm. in diameter (as observed), the hilar indentation slight, usually on short axis, the testa castaneous.

TYPE LOCALITY: Perak, Malay Peninsula; although King did not cite a collector's number, the data given with his original description agree precisely with that accompanying "King's collector" *3463*. I have no doubt that the sheet of this at Kew is a duplicate of the type.

DISTRIBUTION: Malay Peninsula, Borneo, Bangka Island, and perhaps other islands in this general region. See map, *fig. 40*. Altitudes of 200–1200 m. are recorded, and habitats such as forest or jungle.

MALAY PENINSULA: PERAK: *B. Scortechini* (K); Larut Hills, King's collector [*H. Kunstler?*] *3463* (TYPE COLL., K), *3700* (K). PAHANG: Fraser Hill, *M. R. Henderson 11562* (UC).

BORNEO: BRITISH NORTH BORNEO: Dallas, Mt. Kinabalu, *J. & M. S. Clemens 27272* (A, UC); Colombon River, Mt. Kinabalu, *J. & M. S. Clemens 33836* (A, UC). SARAWAK: Without detailed data, *O. Beccari 1637* (K).

ISLAND?: "Archipel. Ind.," *J. E. Teysmann* (*?*) *48* (K).

CULTIVATED: *Hort. Bog. 46* (*XI–A–6*) (K, US) (Buitenzorg, said to be originally from Bangka Island).

COLOR NOTES: The perianth-segments are cream-colored or perhaps reddish-tinged; flowers have been collected in September or October (Malay Peninsula) or June and November (Borneo). Nearly mature fruits have been obtained in December (Malay Peninsula).

SYNONYMY: The cited references to *K. scandens* list *Becarri 1637*, which I believe represents *K. lanceolata*.

The four preceding species of § *Sarcocarpon*, described above, are characterized by having the pseudostyle terminate in a flaring and often peltate pseudostigma. On the contrary, *K. lanceolata* and the remaining species in my treatment (with the possible exception of *K. Clemensiae*, known only from ♂ flowers) have the pseudostyle produced into a subulate or laterally flattened tip. In the other sections of *Kadsura* the character of the pseudostyle is less flexible. This character, of course, is difficult to use, but each of the remaining species of § *Sarcocarpon* has additional characters which serve to distinguish it from the immediate allies of *K. scandens*. *Kadsura lanceolata*, for instance, has uniformly small leaves and flowers; its separation from *K. scandens* in the Malay Peninsula may at times prove difficult, but I believe it to be a reasonably distinct entity.

A specimen probably collected by Teysmann and bearing the notation "Archipel. Ind.," cited above, also carries the inscription "Akar Toehatoeh." I assume that this refers to a local name, although it may possibly be a reference to Akar Island in the Anambas group.

20. **Kadsura** (§ *Sarcocarpon*) **borneensis** sp. nov.

Planta monoica vel forsan interdum dioica, ubique glabra; ramulis hornotinis fusco-purpurascentibus 2–6 mm. diametro, annotinis fuscescentibus paullo crassioribus; squamis basi ramulorum hornotinorum pluribus coriaceis late deltoideis 3–4 × 6–7 mm. caducis; foliis 8–12 per ramulum hornotinum; petiolis nigrescentibus 12–30 mm. longis 1.5–3 mm. diametro; laminis coriaceis in sicco utrinque fusco-brunneis ovato-ellipticis, (8–) 11–17 cm. longis, (4–) 5.5–9 cm. latis, basi rotundatis et in petiolum abrupte decurrentibus, apice in acuminem 10–15 mm. longum subacutum attenuatis, margine integris vel obscure undulatis et paullo recurvatis, utrinque ob glandulas immersas rugulosis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 5–9 subadscendentibus subrectis supra paullo elevatis vel impressis subtus prominentibus, rete venularum utrinque immerso vel subtus prominulo; floribus axillaribus solitariis, bracteis basalibus paucis nigrescentibus subcoriaceis late deltoideis 1.5–2 × 2–3 mm. obtusis minute ciliolatis subpersistentibus; floribus ♂: pedicellis sub anthesi brevissimis 2–3 mm. longis circiter 1.5 mm. diametro, bracteolis 2 vel 3 subcoriaceis ovato-deltoideis 1 ×2–3 mm. obtusis ciliolatis; segmentis perianthii circiter 17 omnino subcarnosis vel coriaceis siccitate fuscescentibus margine anguste scariosis eciliatis, extimis deltoideis obtusis circiter 2 × 3 mm. maximis ellipticis 11–14 × 7–9 mm., intimis obovato-ellipticis ad 9 × 4 mm. reductis; androecio subgloboso sub anthesi 4.5–5 mm. diametro; staminibus circiter 3-seriatis 20–23 turbinatis angulatis 1.6–1.8 mm. longis (altis) basi minute stipitatis, connectivo 1.3–1.6 mm. lato et crasso apice complanato, thecis oblongo-ellipsoideis 1–1.3 mm. longis oblique verticalibus dorsali-lateralibus angulo dorsali obtuso connectivi disjunctis basi saepe subcontiguis; floribus ♀ post anthesin solis visis: pedicellis ut ♂ sed ad 5 mm. longis et 2 mm. diametro; perianthio non viso; gynoecio subgloboso-ellipsoideo post anthesin 7–8 mm. diametro; carpellis circiter 5-seriatis circiter 35 (vel ultra?), ovario obovoideo vel oblongo-turbinato ad 2–3 mm. longo apice convexo, cristis stigmatiferis angustis membranaceis margine ciliolatis distaliter in pseudostylum lateraliter complanatum circiter 0.5 mm. longum obtusum productis, basi haud appendiculatis, ovarii pariete superne valde incrassato coriaceo, loculo basali, ovulis 2 vel 3 pendulis; pedicellis sub fructu non visis, capitulis subglobosis ad 7 cm. diametro (submaturis), carpellis coriaceis anguste obovoideis, 26–30 mm. longis et apice rotundata 12–15 mm. latis (maximis visis), pericarpio superne valde incrassato; seminibus 1 vel 2 (vel 3?) saepe collaterali-superpositis pendulis complanato-ovoideis vel -subglobosis, 7–9 mm. longis latisque, sinu hili inconspicuo superiore, testa castanea. FIG. 41, a.

TYPE LOCALITY: Mt. Kinabalu, Borneo; type, *Clemens 34425*, a monoecious specimen with the best available flowers, cited below.

DISTRIBUTION: British North Borneo and Sarawak, at recorded elevations of 900–1500 m., presumably in forest. See map, *fig. 40*.

BORNEO: BRITISH NORTH BORNEO: Colombon basin, Mt. Kinabalu, *J. & M. S. Clemens 34425* (A, UC no. 555,807 TYPE), Aug. 15, 1933; Penibukan, Mt. Kinabalu, *J. & M. S. Clemens 30555* (A, UC); west of Penibukan, *J. & M. S. Clemens 31889* (A, UC); Dehobong River, Mt. Kinabalu, *J. & M. S. Clemens 40493* (A). SARAWAK: Without detailed data, *O. Beccari 2720* (K).

COLOR NOTES: The perianth-segments are yellow, the androecium and gynoecium pink; flowers have been obtained in August and September. The available fruits, apparently mature, are said to be green, and they were collected in December and March.

Kadsura borneensis is a very distinct species, characterized primarily by its very short pedicels, the flowers and fruits appearing subsessile, and by its brown, thick, very uniform leaves with ascending and nearly straight secondary nerves. The character of the pseudostyle indicates a closer relationship to *K. lanceolata* than to *K. scandens*, but from both of these the new species is superficially distinguishable.

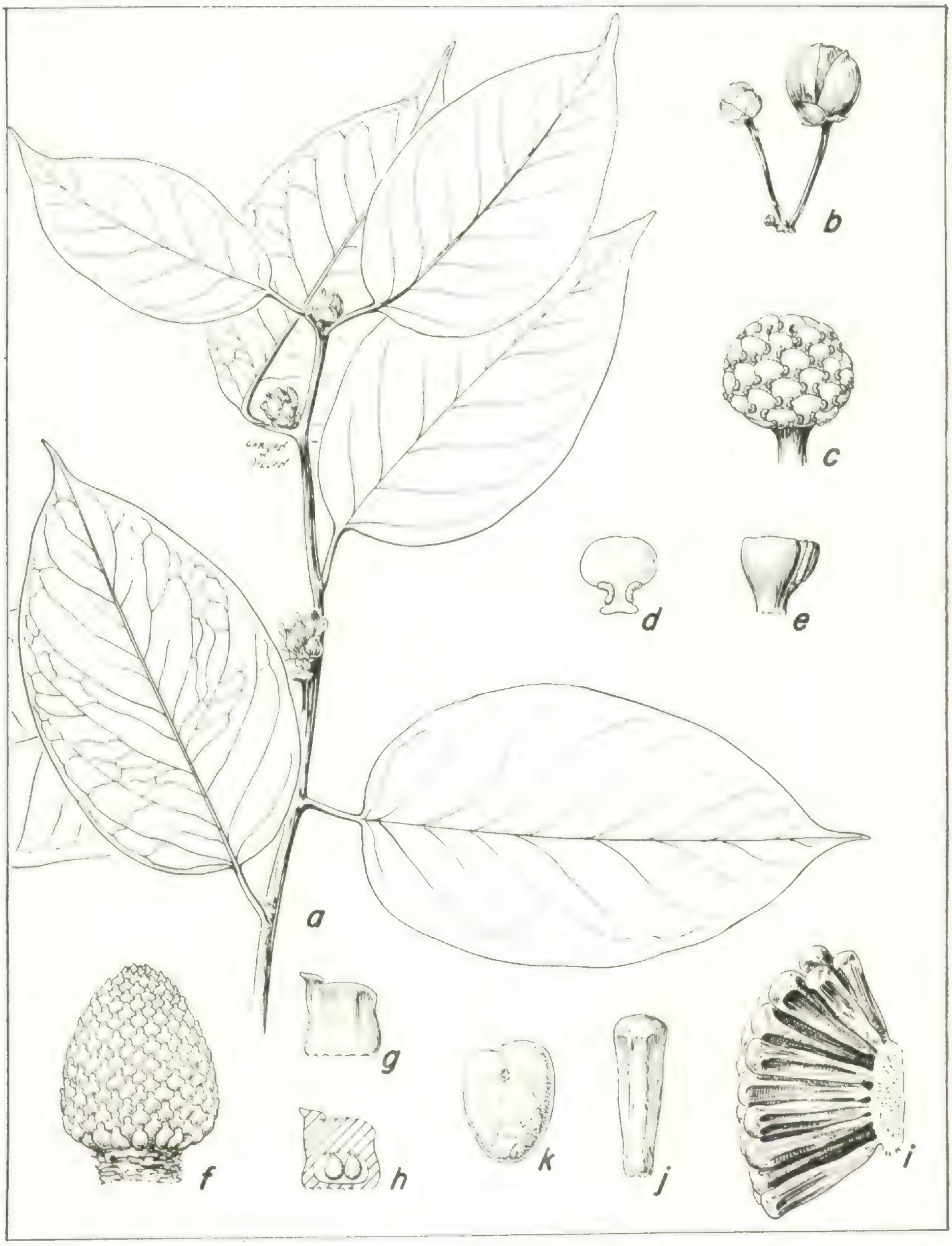

FIG. 41. *Kadsura* § *Sarcocarpon*. *a*. *K. borneensis:* flowering branchlet, × ½. *b–e*. *K. celebica: b*. flowers, × 1; *c*. androecium, × 3; *d*. stamen, top view, × 5; *e*. stamen, lateral view, × 5. *f–k*. *K. marmorata: f*. gynoecium, × 3; *g*. carpel, × 10; *h*. longitudinal section of carpel, × 10; *i*. portion of nearly mature fruit, showing a few carpels, × ½; *j*. essentially mature carpel, × ½; *k*. seed, × 2. *Fig. a* drawn from *Clemens 34425; b–e* from *Sarasin 584; f–h* from *Elmer 11718; i–k* from *Clemens 29250*.

21. **Kadsura** (§ *Sarcocarpon*) **Clemensiae** sp. nov.

Planta ut videtur dioica, ubique glabra; ramulis hornotinis stramineo-purpurascentibus elongatis 2–5 mm. diametro, annotinis cinerascentibus robustioribus;

squamis basi ramulorum hornotinorum fugacibus non visis; foliis pluribus per ramulum hornotinum; petiolis 15–35 mm. longis ad 2 mm. diametro basi et apice incrassatis; laminis subcoriaceis in sicco supra fusco-olivaceis subtus paullo pallidioribus late ovatis, (10–) circiter 15 cm. longis, (6–) 9.5–11.5 cm. latis, basi rotundatis et in petiolum subito decurrentibus, apice in acuminem ad 15 mm. longum obtusum attenuatis, margine integris anguste revolutis, costa supra impressa subtus prominente, nervis secundariis utrinsecus circiter 8 arcuato-patentibus supra inconspicue subtus evidenter elevatis, rete venularum utrinque subplano vel leviter prominulo; floribus axillaribus vel e ramulis infra folia enatis, solitaris vel in glomerulis 2–4 aggregatis, bracteis basalibus paucis papyraceis deltoideis ad 2 mm. longis latisque; floribus ♂ solis visis: pedicellis rugulosis sub anthesi 5–6 mm. longis circiter 1.5 mm. diametro, bracteolis 3 vel 4 ut bracteis; segmentis perianthii circiter 13, exterioribus papyraceis obscure ciliolatis, interioribus carnosis plerumque eciliatis, extimis ovato-deltoideis obtusis 2–2.5 × 2.5–3 mm., maximis elliptico-oblongis circiter 9 × 6–7 mm. obscure glandulosis, intimis oblongo-obovatis ad 6–8 × 3.5–4.5 mm. reductis; androecio subgloboso sub anthesi circiter 4 mm. diametro, columna clavata; staminibus circiter 3-seriatis plus minusve 21 carnosis 1–1.3 mm. longis (altis), connectivo crasse carnoso irregulariter oblongo-obovoideo angulato 1.3–1.5 mm. lato et crasso apice complanato obscure glanduloso, thecis oblique verticalibus oblongo-ellipsoideis 0.7–0.8 mm. longis angulo superiori-dorsali connectivi disjunctis; floribus ♀ et fructibus non visis.

TYPE LOCALITY: Rejang River, Sarawak; type, *Clemens 22115*.

DISTRIBUTION: Known only from the type collection, made in forest. See map, *fig. 40*.

BORNEO: SARAWAK: Gat, upper Rejang River, *J. & M. S. Clemens 22115* (A TYPE), in 1929.

Although only ♂ flowers have been discovered on the single specimen known, I have not dissected all of the attached flowers, and it is possible that the specimen may be monoecious. No notes as to flower-color or date of flowering are available. I find it impossible to refer the cited specimen to any known species and therefore venture to describe it, although the material is far from good. Its alliance is probably with the preceding species, *K. borneensis*, from which it differs in foliage and in its longer pedicels, as noted in my key to species.

22. **Kadsura** (§ *Sarcocarpon*) **ultima** sp. nov.

Schizandra axillaris sensu Merr. in Philip. Jour. Sci. Bot. 11: 270. 1916; non Hook. f. & Thoms.

Planta monoica ubique glabra, ramulis gracilibus elongatis, hornotinis 1–3 mm. diametro; squamis basi ramulorum hornotinorum pluribus fugacibus; foliis ut videtur 5–8 per ramulum hornotinum; petiolis 10–20 mm. longis 1.5–2 mm. diametro; laminis chartaceis vel subcoriaceis in sicco utrinque fusco-brunneis oblongo-ellipticis, 9–12.5 cm. longis, 3–5.2 cm. latis, basi late obtusis, apice in acuminem ad 10 mm. longum obtusum attenuatis, margine integris et anguste recurvatis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 5 vel 6 arcuato-adscendentibus supra leviter subtus evidenter elevatis, rete venularum utrinque immerso vel haud prominulo; floribus axillaribus solitariis, bracteis basalibus paucis reniformibus minutis; floribus ♂: pedicellis ante anthesin 3–4 mm. longis circiter 1 mm. diametro, bracteolis 3 vel 4 papyraceis suborbicularibus ciliolatis 1–2 mm. longis latisque; segmentis perianthii circiter 7, extimo bracteolis simili, aliis tenuiter vel crasse carnosis eciliatis, minoribus elliptico-oblongis 6–7 × 5 mm., maximis (ante anthesin) ellipticis circiter 7 × 6 mm., intimis obovatis ad 5–6 × 3–4 mm. reductis; androecio subgloboso 4–5 mm. diametro, columna clavata basi circiter 2 mm. diametro; staminibus 3- vel 4-seriatis circiter 20, filamentis liberis subnullis, connectivo irregulariter obovoideo crasse carnoso

inconspicue immerso-glanduloso, circiter 1.3 mm. longo (alto) et 1.5 mm. lato et crasso, apice complanato, thecis ellipsoideis circiter 0.8 mm. longis angulo dorsali angusto connectivi disjunctis; floribus ♀: pedicellis ut ♂ vel post anthesin ad 7 mm. longis; perianthio ut videtur ut ♂, gynoecio subgloboso sub anthesi circiter 5 mm. diametro; carpellis 3- vel 4-seriatis circiter 32, ovario ellipsoideo ad 1.5 × 1 mm., cristis stigmatiferis albidis molliter carnosis inconspicuis distaliter in pseudostylum lateraliter complanatum 0.2–0.3 mm. longum productis, basi in ovarium decurrentibus, ovarii pariete crasse carnoso uniformi, ovulis 2 pendulis; fructibus non visis.

TYPE LOCALITY: Amboina; type, *Robinson 2005*.

DISTRIBUTION: Known only from the type collection, made at 350 m. alt., without habitat data. See map, *fig. 40*.

AMBOINA: Hatalae, *C. B. Robinson 2005* (K, US no. 775,374 TYPE), Oct. 24, 1913.

COLOR NOTES: The single known specimen, on the date collected, bore yellow-green flowers and young green fruits (fruits not available with our material).

SYNONYMY: The cited reference to *Schizandra axillaris* is based on the type of my new species.

This new species represents the ultimate intrusion of the Schisandraceae eastward in Malaysia, at least on the basis of material now available. Like *K. lanceolata* and *K. borneensis*, *K. ultima* has an unexpanded pseudostyle, but it is at once distinguished by its reduced number of perianth-segments and stamens and by its comparatively long and narrow leaf-blades. Although the available specimens of the new species are unsatisfactory, they so definitely represent an undescribed entity that I do not hesitate to record as new this noteworthy range-extension of the genus.

ENTITIES EXCLUDED FROM THE SCHISANDRACEAE

SCHIZANDRA ELONGATA var. MARMORATA Hall. f. in Bull. Herb. Boiss. **6**: 214. *pl. 5, fig. 1.* 1898.

This trinomial is based upon: "Ostsumatra, Deli, Tandjung Gunung (JAHERI 1895, Hort. Bog.)." The specimen, which Hallier described adequately enough, was sterile. This variety was proposed as a novelty and is not to be confused with *Schizandra marmorata* Hemsl. or *Sphaerostema marmorata* E. G. & A. Henderson, binomials which elsewhere in this work I have referred to *Kadsura marmorata*, a Bornean species. Hallier was aware of some of the earlier literature referring to the Bornean plant and apparently thought that the Sumatran plant might be the same, but nevertheless his trinomial is not based upon any earlier epithet.

The sterile Sumatran plant, in the shape of its leaves and in its general aspect, cannot possibly be referred to the Javanese *Schisandra elongata* (Bl.) Baill. The illustration shows stipule-like organs arising near the bases of petioles, although these are not mentioned in the text. Unless some competent anatomical study of the type proves the contrary, I see no reason whatever for the reference of this sterile specimen to the Schisandraceae.

KADSURA BLANCOI Azaola in Blanco, Fl. Filip. ed. 2. 594. 1845, ed. 3. **3**: 118. 1879.

Schizandra elongata sensu F.-Vill. Nov. App. Fl. Filip. 4. 1880; Merr. Enum. Phil. Fl. Pl. **2**: 154. 1923; non Hook. f. & Thoms.

Kadsura Blancoi is the basonym of **Phytocrene Blancoi** (Azaola) Merr. [Icacinaceae] in Philip. Jour. Sci. Bot. **2**: 432. 1907, Sp. Blanco. 237. 1918.

KADSURA PUBESCENS Miq. Fl. Ned. Ind. Suppl. 620. 1862 = **Actinidia Miquelii** King in Jour. As. Soc. Beng. **59** (2): 196. 1890, in Ann. Bot. Gard. Calcutta **5**: 145. *pl. 176.* 1896.

The original description of this species, based on a collection by Teysmann, in the Addenda to Miquel's Prodromus Florae Sumatranae, indicates that a species of Schisandraceae is not represented. I am indebted to Dr. J. Lanjouw (Utrecht) and Dr. S. J. van Ooststroom (Leiden) for the information concerning its identity; the type of *K. pubescens* is in the herbarium at Utrecht.

Although King's species is typified by two collections from Perak, he notes: "I have carefully examined a type specimen of Miquel's *Kadsura pubescens* from Sumatra named by the author's own hand; and there is no doubt whatever that it is an *Actinidia* and not a *Kadsura;* nor is there any that it is identical with the above quoted numbers [*5437, 8789*] of the Calcutta collector from Perak. Miquel is quite wrong in describing his plant as having 3 sepals and 6 petals; there being 5 in each whorl."

The fact that King did not take up the epithet *pubescens* for this *Actinidia* is a situation which cannot now be remedied, due to the subsequent binomial *Actinidia pubescens* Ridley (1917) for [presumably] another species. In his Fl. Malay Penins. **1**: 206. 1922, Ridley reduces *Actinidia Miquelii* King to *A. Championii* Benth.

Insufficiently known entities in the Schisandraceae

Schizandra elongata var. dentata Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 49. 1905 [repr. Contr. Fl. As. Or. **2**: 49. 1907].

This trinomial is based upon several Ducloux collections from Yünnan (none of which I have seen) and upon *Harmand* (in herb. Pierre) *3321,* from Indo-China. I believe the last to represent *Kadsura heteroclita,* and the trinomial is cited under that as a synonym in part. The identity of the Ducloux specimens must be ascertained by examination; possibly a variety of *Schisandra propinqua* is represented.

Kadsura japonica var. variegata Laval. Arbor. Segrez. 9, nomen. 1877; Bean, Trees and Shrubs Brit. Isles **1**: 678. 1914; Rehder, Man. Cult. Trees and Shrubs 260. 1927.

Kadsura japonica f. *variegata* Siebold ex Beissn., Schelle, & Zabel, Handb. Laubh.-Benen. 102, nomen. 1903.

This entity has never been adequately described. Bean, in 1914, states: "Leaves with an irregular border of creamy white." From the published records it is, of course, impossible to place the plant. A sterile specimen from a cultivated plant (*G. Nicholson 1867* [A], coll. Arboretum of Royal Bot. Gardens, Kew, July 28, 1880), identified as *"Kadsura japonica variegata,"* appears not to represent the genus or the family, but I cannot suggest its place.

Kadsura scandens var. cuspidata Bl. ex Koorders, Exkursionsfl. Java **2**: 242, nomen. 1912.

This trinomial appears following Koorders' discussion of *K. scandens,* with the implication that it refers to Bornean specimens. Since I have recognized four species of *Kadsura* in Borneo (but not including *K. scandens*), it is impossible to place the trinomial without additional information as to its source.

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LIST OF CITED SPECIMENS

In the following list genera are indicated by these abbreviations: *I.* = *Illicium; K.* = *Kadsura; S.* = *Schisandra.* Only numbered collections are included, specimens indicated in the preceding text by the collector's name only (or with date) being omitted. Also omitted are numbers in herbarium series (e. g. Lingnan University, Canton Christian College, etc.); such numbers are usually given parenthetically in the text above, but in this list I prefer to use the collector's field number. Where the field number has been suppressed in favor of an herbarium number (e. g. Bureau of Science, Manila), the collector's name and the only available number are given below. Cultivated specimens are usually not included in this list, but they have been cited in the text above; only rarely are such specimens accompanied by a collector's name and number.

ALLISON, A. 15. *K. longepedunculata.*
ANDERSON, T. 7. *S. grandiflora;* 350. *S. neglecta.*
ANECT, BRO. 13. *I. floridanum.*
ARSÈNE, G. 11603, 11634, 11944. *I. floridanum.*
BACKER, C. A. 12291. *S. elongata.*
BAKER, C. F. 1215. *I. floridanum.*
BAKER, C. H. 500a, 500c, 500y, 500z, 501a, 501b, 502, 541. *I. parviflorum.*
BALANSA, B. 4180. *K. heteroclita.*
BANGHAM, W. N., & C. M. BANGHAM. 703, 705. *K. scandens.*
BARNES, W. D. 10876. *I. Ridleyanum.*
BARTLETT, H. H. 6037. *I. philippinense.*
BEATTIE, R. K., & Y. KURIHARA. 10104. *S. chinensis;* 10355, 10474. *I. anisatum.*
BECCARI, O. 320. *K. scandens;* 367. *S. axillaris;* 667. *K. scandens;* 1637. *K. lanceolata;* 2720. *K. borneensis.*
BIS RAM. 423. *S. propinqua typica;* 2324. *S. grandiflora.*
BIST, H. S. 2. *S. grandiflora.*
BISWAS, K. 4680. *K. heteroclita.*
BLANTON, O. 42. *I. floridanum.*
BOCK, C., & A. v. ROSTHORN. 131. *S. glaucescens.*
BOR, N. L. 2685. *I. Griffithii.*
BROOKS, W. P. 20, 579. *S. chinensis.*
BROWN, C. A. 5214. *I. floridanum.*
BURKILL, I. H., & M. HANIFF. 12657, 12855. *I. tenuifolium tenuifolium.*
—— & R. E. HOLTTUM. 8444. *I. peninsulare;* 8583. *I. Ridleyanum.*
BUSH, B. F. 341. *I. floridanum.*
CANBY, W. M. 8, 9. *I. floridanum.*
CARLES, W. R. 636, 691. *K. longepedunculata.*
CAVALERIE, J. 27. *S. sphenanthera;* 578. *I. majus;* 1014. *I. Dunnianum;* 1023, 2453, 3046. *K. coccinea;* 3336. *K. longepedunculata;* 3849. *I. majus;* 4118. *S. Henryi typica;* 4484, 4491. *I. Dunnianum;* 7112, 7113. *K. longepedunculata;* 7312. *I. majus.*
CHAMPION, J. G. 36. *K. heteroclita.*
CHAND, C. S. 2. *S. propinqua typica.*
CHEN, F. H. 402, 618. *S. chinensis.*
CHEN, H. C. 1274, 3033, 3127, 3194. *K. longepedunculata.*
CHEN, P. E. 2638. *K. longepedunculata.*
CHEN, S. 293. *S. viridis;* 660. *S. Henryi marginalis;* 662, 3171. *I. lanceolatum;* 3258. *S. viridis;* 3496, 4378. *I. lanceolatum.*
CHEN, Y. 15205. *S. sphenanthera.*
CHENG, W. C. 3898. *I. lanceolatum.*
CHEO, H. C. 126. *S. viridis.*
CHIAO, C. Y. 1163. *S. propinqua sinensis;* 1611. *S. lancifolia;* 1628. *S. rubriflora;* 14517, 14780, 18628, 18667, 18727, 18910. *K. longepedunculata.*

—— & C. S. Fan. 230. *S. Henryi typica;* 349. *K. longepedunculata;* 773. *S. Henryi typica.*

Ching, R. C. 1606. *S. Henryi marginalis;* 1641. *I. lanceolatum;* 1781. *S. viridis;* 2123. *I. lanceolatum;* 2176. *K. longepedunculata;* 2256. *I. lanceolatum;* 2336. *S. Henryi marginalis;* 2519. *I. lanceolatum;* 2570. *K. longepedunculata;* 2591, 3008. *S. sphenanthera;* 3159. *K. longepedunculata;* 3166, 4777. *S. viridis;* 4858. *I. lanceolatum;* 5043. *K. longepedunculata;* 5060. *I. lanceolatum;* 5132. *S. viridis;* 5843, 5934. *K. coccinea;* 6236. *? S. Henryi marginalis;* 6825, 6843. *I. verum;* 6994. *S. Henryi typica;* 7193. *K. heteroclita;* 7202. *I. majus;* 7232. *K. heteroclita;* 7589. *I. verum;* 8140. *I. Dunnianum;* 20572, 20644. *S. sphaerandra typica;* 21484, 21830. *S. neglecta;* 22003, 30216. *S. sphaerandra typica.*

—— & C. L. Tso. 498. *S. sphenanthera;* 530. *I. lanceolatum.*

Chow, H. C. 118. *I. Henryi typicum;* 210. *S. sphenanthera;* 567. *S. propinqua sinensis;* 689. *S. sphenanthera;* 707. *I. Henryi typicum;* 898, 1439. *S. propinqua sinensis.*

Chu, K. L. 2583. *S. sphenanthera.*

Chun, L. H. 91204, 91343, 91344, 91345, 91364. *I. verum.*

Chun, N. K., & C. L. Tso. 43327. *K. coccinea;* 43783. *I. ternstroemioides;* 44132. *K. oblongifolia;* 44173. *I. ternstroemioides;* 44188. *K. coccinea.*

Chun, W. Y. 3793. *I. Henryi typicum;* 3820. *S. glaucescens;* 4283. *I. Henryi typicum;* 5152. *S. Henryi typica;* 5719. *K. oblongifolia;* 7122. *I. ternstroemioides.*

—— & S. S. Chien. 5127. *S. propinqua sinensis.*

Chung, H. H. 2052, 2903, 6632, 7552. *K. longepedunculata;* 7609. *I. lanceolatum.*

—— & S. C. Sun. 478. *I. lanceolatum;* 580. *K. longepedunculata;* 582. *I. lanceolatum;* 602. *K. longepedunculata;* 732. *S. viridis.*

Chung, Z. S. = T. S. Tsoong.

Clarke, C. B. 7325. *S. neglecta;* 12217A. *S. grandiflora;* 24957. *K. heteroclita;* 26715A, 26752A, B. *S. neglecta;* 36592A. *K. heteroclita;* 38603D. *S. neglecta;* 42082B, C. *K. heteroclita.*

Clemens, J., & M. S. Clemens. 3768. *K. coccinea;* 4192. *I. parvifolium;* 22115. *K. Clemensiae;* 26235. *K. marmorata;* 27111. *I. kinabaluense;* 27272. *K. lanceolata;* 28522 = 28803, 29250, 29354. *K. marmorata;* 29837. *I. kinabaluense;* 30381. *K. scandens;* 30555. *K. borneensis;* 31673. *I. Stapfii;* 31889. *K. borneensis;* 33836. *K. lanceolata;* 34425. *K. borneensis;* 35039, 35060. *I. Stapfii;* 36896. *K. marmorata;* 40084. *I. Stapfii;* 40493. *K. borneensis;* 40895, 50154. *I. kinabaluense.*

Clemens, M. S. 683. *K. marmorata;* 1145. *K. philippinensis;* 10394. *K. marmorata;* 10949, 10995. *I. Stapfii;* 16454. *K. paucidenticulata.*

Collett, H. 774. *S. propinqua intermedia;* 5655c. *S. grandiflora.*

Corner, E. J. H. 29213. *I. peninsulare.*

Correll, D. S., & H. B. Correll. 9230. *I. floridanum.*

Curran, H. M., & M. L. Merritt. 9515. *I. philippinense.*

Curtis, C. 1529, 2440. *K. scandens.*

Curtiss, A. H. 73, 6378. *I. floridanum.*

Datta, B. C. 1. *S. grandiflora;* 2. *S. propinqua typica.*

David, A. 1839. *S. chinensis.*

Dickason, F. G. 5016. *S. gracilis;* 5076. *S. propinqua intermedia.*

Dolman, H. C. 25933. *I. Ridleyanum;* 27604. *I. tenuifolium obovatum.*

Dorsett, P. H., & J. H. Dorsett. 4098. *S. chinensis.*

—— & W. J. Morse. 119. *I. anisatum;* 874, 1330. *S. chinensis.*

Drummond, J. R. 3029, 6288, 6290, 8327, 14836. *S. grandiflora.*

Ducloux, F. 168. *I. Simonsii;* 468. *S. propinqua intermedia;* 735. *S. micrantha.*

Dunn, S. T. 806. *I. lanceolatum;* 2330, 2442. *S. viridis.*

Duthie, J. F. 7244. *S. grandiflora.*

Earle, F. S. 2044. *I. floridanum.*

Edgeworth, M. P. 54. *S. grandiflora.*

Ekman, E. L. H.2230, H.8209, H.9002. *I. Ekmanii.*

Elmer, A. D. E. 8700, 11498. *K. philippinensis;* 11718, 13505. *K. marmorata;* 17032. *K. paucidenticulata;* 21696. *K. marmorata.*

Esquirol, J. 58. *S. Henryi typica;* 116, 1555. *S. propinqua sinensis.*

Eyerdam, W. J. 361. *I. Ekmanii.*

Faber, E. 160. *S. rubriflora;* 781. *S. propinqua sinensis;* 1718. *I. lanceolatum;* 1719. *K. longepedunculata.*

Fairchild, D. 1044. *K. scandens.*

Fan, C. S., & Y. Y. Li. 19. *K. longepedunculata;* 220. *S. sphenanthera;* 221. *S. viridis;* 228. *K. longepedunculata;* 245. *I. lanceolatum;* 280. *S. Henryi typica;* 345. *I. majus;* 609. *K. longepedunculata.*

Fang, W. P. 408. *S. tomentella;* 429. *S. Henryi typica;* 831. *S. rubriflora;* 855. *S. glaucescens;* 893. *S. rubriflora;* 1116, 1121. *S. Henryi typica;* 1202. *S. rubriflora;* 1395. *S. pubescens typica;* 1585. *S. rubriflora;* 2171. *S. pubescens pubinervis;* 2172, 2238. *S. sphenanthera;* 2374. *S. rubriflora;* 2632. *S. pubescens typica;* 2683. *K. polysperma;* 2788. *S. rubriflora;* 3200. *I. micranthum*; 3650. *S. rubriflora;* 6368. *K. longepedunculata;* 7362. *S. pubescens typica;* 7658, 7765. *S. pubescens pubinervis;* 7834, 7838. *I. micranthum;* 8270. *S. rubriflora;* 8330. *S. pubescens pubinervis.*

Farges, R. P. 208 bis. *I. Henryi multistamineum.*

Faurie, U. 497, 498. *S. chinensis;* 1535. *I. arborescens;* 1678. *S. repanda;* 1679. *K. japonica;* 3004. *S. chinensis;* 3832. *I. anisatum;* 5391. *S. repanda;* 6214, 6913, 6988. *S. chinensis;* 7727. *I. anisatum;* 8159. *S chinensis;* 15687. *I. anisatum.*

Feng, K. M. 934, 1217. *S. sphaerandra typica;* 2844. *S. neglecta;* 2883. *S. sphaerandra typica;* 3149. *S. neglecta.*

Fénix, E. 12629. *K. philippinensis.*

Fenzel, G. 591. *I. Henryi typicum.*

Forbes, H. O. 800a, 801a, 1400, 2882. *K. scandens.*

Forrest, G. 2122. *S. sphaerandra typica;* 4106, 4701. *I. Simonsii;* 4797, 5663. *S. sphaerandra typica;* 7181. *S. sphaerandra pallida;* 7622. *S. neglecta;* 7686, 7692. *S. propinqua intermedia;* 8127, 9077, 9658. *I. Simonsii;* 10197. *S. lancifolia;* 11845. *S. propinqua intermedia;* 11895. *I. Merrillianum;* 11912. *I. Simonsii;* 14222. *S. propinqua intermedia;* 15724. *I. Simonsii;* 15825. *S. neglecta;* 15860. *S. propinqua intermedia;* 16567. *I. Simonsii;* 16589. *S. lancifolia;* 17695. *I. Merrillianum;* 17820. *I. macranthum;* 19125. *S. propinqua intermedia;* 19980. *I. Simonsii;* 21523. *S. propinqua intermedia;* 21524. *S. lancifolia;* 22245. *S. propinqua intermedia;* 26279. *I. Simonsii.*

Gamble, J. S. 699A, 1888A, 1889A. *S. grandiflora;* 1890A, 1891. *S. neglecta;* 6035E, F, 6094A. *S. grandiflora;* 7699. *K. heteroclita;* 8223. *S. grandiflora;* 9819, 10002. *K. heteroclita;* 23013, 23019, 26594, 26742, 28024. *S. grandiflora.*

Gardner, G. 35. *K. heteroclita.*

Garrett, H. B. G. 940. *K. ananosma.*

Ghosh, T. M. 2. *S. propinqua typica.*

Gilbert, K. S. 22. *S. chinensis.*

Gould, B. J. 140, 202, 202A. *S. grandiflora.*

Graves, E. W. 627B, 633b. *I. floridanum.*

Gressitt, J. L. 190. *S. arisanensis;* 419. *I. philippinense;* 613. *K. japonica;* 1424. *K. coccinea;* 1485. *S. viridis.*

Griffith, W. 7, 62 (or 626). *I. Griffithii;* 73. *K. heteroclita;* 74. *K. scandens;* 75. *S. grandiflora;* 76, 77. *S. neglecta;* 422. *I. Griffithii;* 1729. *S. grandiflora.*

Haines, H. H. 794, 2228. *S. grandiflora.*

Hallier, H. 750. *S. elongata;* 751. *K. scandens.*

Hance, H. F. 601. *K. coccinea.*

Handel-Mazzetti, H. v. 119. *S. propinqua sinensis;* 195. *S. Henryi typica;* 370. *K. longepedunculata;* 595. *S. sphenanthera;* 668. *I. Simonsii;* 719. *K. coccinea;* 735. *S. Henryi typica;* 784. *S. sphenanthera;* 812. *K. longepedunculata;* 1611. *S. lancifolia;* 1943. *S. propinqua sinensis;* 2962. *S. sphaerandra typica;* 6089. *S. neglecta;* 8740. *S. sphaerandra pallida;* 8820 in part. *S. neglecta;* 8820 in part, 10017. *S. propinqua intermedia.*

Haniff, M. 4017. *I. tenuifolium tenuifolium.*

Harbison, T. G. 848, 5876, 5892, 6091. *I. floridanum.*

Harper, R. M. 3377. *S. glabra.*

—— & H. K. Svenson. 7449. *I. floridanum.*

Haviland, G. D. 1272. *I. Stapfii.*

Henderson, M. R. 11562. *K. lanceolata.*

Henry, A. 329. *K. coccinea;* 1165. *I. Henryi typicum;* 1284. *K. Matsudai;* 1316. *I. Tashiroi;* 1544. *S. propinqua sinensis;* 1553, 1681. *K. Matsudai;* 1693. *S. propinqua sinensis;* 1785. *S. pubescens typica;* 1827. *S. glaucescens;* 2028, 3243, 3354. *S. propinqua sinensis;* 3388, 3388B, 3388C, 3388D. *I. Henryi typicum;* 3446, 3469. *S. sphenanthera;* 3699. *S. propinqua sinensis;* 3848. *I. Henryi typicum;* 3961. *S. propinqua sinensis;* 4040, 4059. *S. sphenanthera;* 4084, 4156, 4500. *I. Henryi typicum;* 4609. *S. sphenanthera;* 5478. *S. glaucescens;* 5527, 5527A. *S. sphenanthera;* 5547. *I. Henryi typicum;* 5725. *S. glaucescens;* 5907. *S. pubescens typica;*

5931. *S. glaucescens;* 6219. *S. propinqua sinensis;* 6226. *S. Henryi typica;* 6292, 6383. *S. glaucescens;* 6433, 7496. *K. longepedunculata;* 7943, 8796. *S. sphenanthera;* 8798. *S. rubriflora;* 9193, 9193A, 9193B. *S. Henryi typica;* 9451, 9451A, 10182, 10182A, 10182B. *I. macranthum;* 10697. *S. neglecta;* 10719. *S. propinqua intermedia;* 10734. *K. coccinea;* 10854. *S. plena;* 11211. *S. micrantha;* 11749. *S. plena;* 11810. *K. coccinea;* 11893. *S. plena;* 12022, 12022A, 12022B. *S. Henryi yunnanensis;* 12049. *K. coccinea;* 12108, 12108A. *I. micranthum;* 12192. *S. plena;* 12224, 12224A, 12224B, 12224C. *I. micranthum;* 12312, 12312A, 12312B, 12549. *K. heteroclita;* 13023. *S. propinqua intermedia.*

Hers, J. 243, 424, 452, 860, 887, 1220, 1246, 1335. *S. sphenanthera;* 2154. *S. chinensis;* 3089. *S. sphenanthera.*

Ho, Y. Y. 1138, 1448. *S. viridis;* 1475. *I. lanceolatum.*

Hooker, J. D. 2420. *K. heteroclita.*

How, F. C. 72306. *K. coccinea;* 72334. *K. heteroclita;* 72901. *I. oligandrum;* 73127. *K. heteroclita;* 73537. *K. coccinea;* 73567. *I. ternstroemioides.*

Howard, R. A. 6085, 6207. *I. cubense.*

Hsia, W. Y. 157. *K. longepedunculata.*

Hu, H. H. 25, 565. *K. longepedunculata;* 1118. *S. viridis;* 1305. *I. Henryi typicum;* 1584, 1693. *S. viridis.*

Hubricht, L. B2068. *I. floridanum.*

Ichikawa, K. 183. *I. anisatum.*

Ip, N. K. 40. *K. longepedunculata;* 1589. *S. viridis;* 1804. *I. lanceolatum.*

Ip, Y. S. 764. *K. coccinea.*

Ito, T. 529. *I. philippinense.*

Junghuhn, F. 184. *K. scandens.*

Kanehira, R. 3095. *I. arborescens;* 3263. *K. japonica;* 3278, 3386, 3415. *I. Masa-Ogatai;* 21192. *I. Tashiroi;* 21306. *I. arborescens.*

—— & S. Sasaki. 528. *I arborescens.*

Kanjilal, U. 750. *S. propinqua typica.*

Keng, Y. L. 242. *K. longepedunculata;* 354. *S. Henryi marginalis;* 601. *S. viridis;* 616, 792. *K. longepedunculata;* 1011. *I. lanceolatum.*

Kermode, C. W. D. 16693. *I. Wardii;* 17095. *I. manipurense;* 17179. *I. Simonsii;* 17289. *S. neglecta.*

Kerr, A. F. G. 3296, 6678. *K. heteroclita.*

King, G. ["King's Collector"]. 3463. *K. lanceolata;* 3507. *K. scandens;* 3700. *K lanceolata;* 3785. *K. scandens;* 3816, 6980. *I. tenuifolium tenuifolium.*

Kloss, C. B. 7051. *K. heteroclita;* 14709. *K. scandens.*

Ko, S. P. 52560. *K. coccinea;* 52691, 52919. *S. viridis;* 55898. *I. majus.*

Komarov, V. 652. *S. chinensis.*

Koorder, S. H. 26392β, 31516β. *S. elongata;* 37673. *S. axillaris.*

Kung, H. W. 79. *S. chinensis.*

Kuntze, O. 4700, 5210. *K. scandens.*

Lace, J. H. 4625. *I. cambodianum;* 5149. *K. heteroclita;* 5432, 5875, 5919. *S. propinqua intermedia.*

Lau, S. K. 1635. *K. coccinea;* 1993. *S. viridis;* 2342. *K. longepedunculata;* 2627. *I. brevistylum;* 2725. *K. coccinea;* 4014. *K. longepedunculata;* 4027. *S. viridis;* 4260, 4603. *K. longepedunculata;* 5438, 26324. *I. ternstroemioides;* 26664. *K. coccinea;* 27146. *K. heteroclita;* 27307, 27315. *I. oligandrum;* 27372. *I. ternstroemioides;* 27865. *K. heteroclita;* 28016. *K. oblongifolia;* 28461, 28629. *S. Henryi typica;* 28772. *I. majus.*

Legge, J. 20. *S. grandiflora.*

Lei, C. I. 205. *K. oblongifolia.*

Li, C. F. 11173. *S. chinensis.*

Li, M. K. 2339. *K. coccinea.*

Liang, H. Y. 62198, 62356. *K. heteroclita;* 63280. *K. coccinea;* 63398, 64185, 64197. *I. ternstroemioides;* 64359. *I. oligandrum;* 64844, 64845. *I. ternstroemioides;* 65008. *K. heteroclita;* 69472. *I. verum;* 69746. *K. coccinea;* 69788. *I. verum;* 69963, 70113. *K. longepedunculata;* 70155. *I. verum.*

Licent, E. 1885, 2345, 8409, 12067. *S. chinensis.*

Limpricht, W. 1572. *S. pubescens typica.*

Ling, K. 1125, 1328, 12427. *K. longepedunculata.*

Litvinov, D. 1767, 2072. *S. chinensis.*

Liu, J. C. 1919. *S. chinensis.*

LOHER, A. 23. *K. paucidenticulata;* 13000. *K. philippinensis.*
McATEE, W. L. 3350. *I. floridanum.*
McGREGOR, R. C. 8498. *K. paucidenticulata.*
MACKENZIE, K. K. 3996. *I. floridanum.*
McCLURE, F. A. 471. *I. Dunnianum;* 1668. *K. oblongifolia;* 9383. *I. oligandrum;* 9501. *I. ternstroemioides;* 9524A. *K. coccinea;* 9535. *I. ternstroemioides;* 9542. *K. coccinea.*
MAIRE, E. E. 33. *S. micrantha;* 91. *S. propinqua sinensis;* 177. *S. micrantha;* 196. *S. propinqua intermedia;* 289, 381. *I. Simonsii;* 396. *S. micrantha;* 1647. *S. propinqua intermedia;* 1720, 2923. *S. propinqua sinensis;* 3327. *I. Simonsii;* 3358. *S. rubriflora;* 3359. *S. sphaerandra pallida;* 3650. *S. propinqua sinensis;* 3697. *S. neglecta.*
MATUDA, E. 272. *I. arborescens;* 277, 554. *K. Matsudai.*
MAUNG PO KHANT. 17070. *I. Simonsii.*
MEEBOLD, A. E. 5931. *K. heteroclita;* 9262. *I. Griffithii.*
MERRILL, E. D. 9504. *K. marmorata;* 11015. *K. longepedunculata.*
MERRITT, M. L. 4411. *I. philippinense.*
METCALF, F. P., & T. C. CHANG. 515. *K. longepedunculata.*
MEYER, F. N. 1347. *S. chinensis;* 1531. *K. longepedunculata.*
MJÖBERG, E. 114. *I. cauliflorum.*
MORSE, H. B. 201. *I. verum.*
MOUSSET. 964. *S. elongata.*
NORTON, J. B. 1371. *K. longepedunculata.*
NUR, M. 11247. *I. peninsulare;* 11762. *I. tenuifolium tenuifolium;* 26103. *K. scandens.*
OCAMPO, M. 27965. *K. philippinensis.*
OLDHAM, R. 25, 26. *K. japonica;* 522. *I. anisatum;* 849. *K. japonica.*
ON, U. 2062. *I. angustisepalum.*
PALCHEVSKY, N. 652. *S. chinensis.*
PALMER, E. J. 25094, 26621. *S. glabra;* 35245, 38548, 38624, 38690. *I. floridanum.*
PARKER, R. N. 2312. *I. cambodianum;* 2799, 2827, 3032. *S. grandiflora.*
PARKINSON, C. E. 3133. *S. propinqua intermedia;* 5123. *K. calophylla.*
PARRY, N. E. 296, 429. *K. heteroclita.*
PÉTELOT, A. 1680. *I. majus;* 1776. *I. Petelotii;* 3757. *K. coccinea;* 3758. *I. majus;* 3759. *I. Petelotii;* 3762. *K. heteroclita;* 4788. *S. perulata;* 5796. *I. majus;* 6345. *I. Petelotii.*
PIERRE, L. 1892. *I. cambodianum.*
POILANE, E. 2372. *K. heteroclita;* 12624. *K. angustifolia;* 21753, 21755. *K. coccinea;* 25429. *K. verrucosa.*
POLLARD, C. L. 1162. *I. floridanum.*
—— & W. R. MAXON. 300. *I. floridanum.*
PRATT, A. E. 186. *S. rubriflora.*
PRICE, W. R. 81. *I. philippinense;* 202. *I. arborescens;* 750. *I. philippinense.*
PUNJ, M. L. 3. *S. grandiflora;* 4. *S. propinqua typica.*
PURDOM, W. 117. *S. chinensis;* 1037. *S. sphenanthera.*
PURPUS, C. A. 6137. *I. mexicanum.*
QUISUMBING, E., & M. SULIT. 82365. *K. paucidenticulata.*
RAHMAT SI BOEEA. 7605. *K. scandens.*
RAMOS, M. 23531. *K. paucidenticulata.*
—— & G. EDAÑO. 38640. *K. marmorata;* 38809. *K. philippinensis.*
RAWAT, C. S. 3. *S. grandiflora;* 4. *S. propinqua typica.*
RIBU & RHOMOO. 5604. *S. grandiflora.*
RICH, H. H. 856, B204. *S. grandiflora.*
RIDLEY, H. N. 6242. *K. scandens;* 7218. *I. peninsulare;* 13534. *I. tenuifolium tenuifolium;* 13563. *I. Ridleyanum;* 15691. *I. peninsulare;* 16089, 16268. *I. tenuifolium tenuifolium.*
ROBINSON, C. B. 2005. *K. ultima.*
ROBINSON, H. C., & C. B. KLOSS. 6003. *I. tenuifolium tenuifolium;* 6089. *I. tenuifolium angustifolium.*
ROCK, J. F. 3104. *I. Simonsii;* 3399. *S. sphaerandra typica;* 4039. *S. Wilsoniana;* 4299. *S. lancifolia;* 6247. *I. Simonsii;* 6825. *S. sphaerandra typica;* 7399, 7408. *I. burmanicum;* 8003, 8018. *I. Simonsii;* 8595. *S. sphaerandra pallida;* 8933. *S. neglecta;* 9602, 9603. *S. lancifolia;* 9616, 10232, 11725. *I. Simonsii;* 17292, 18233. *S. sphaerandra typica;* 22018. *S. rubriflora;* 24092, 24699, 25273. *S. sphaerandra typica.*
ROSS, J. 309. *S. chinensis.*
ROSTHORN, A. v. 2326. *I. Henryi multistamineum.*

Rugel, F. 83. *I. floridanum.*
Sarasin, F., & P. Sarasin. 584. *K. celebica.*
Savatier, L. 45. *I. anisatum.*
Saw Maung Mya. 5327. *I. Wardii.*
Schneider, C. 415, 569. *I. Simonsii;* 985, 999. *S. lancifolia;* 1276, 2686, 2807, 3303. *S. sphaerandra typica.*
Scortechini, B. 1869, 1969. *K. scandens.*
Selhi, K. S. 5. *S. grandiflora.*
Seymour, A. B. 32. *I. floridanum.*
Shafer, J. A. 3612, 9047. *I. cubense.*
Shiota, K. 4423. *S. repanda;* 4433. *K. japonica;* 4434. *I. anisatum;* 6494. *S. repanda;* 7296, 8553. *I. anisatum;* 9133. *K. japonica.*
Silvestri, G. C. 732. *I. Henryi typicum.*
Simons. 191. *K. heteroclita.*
Sin, S. S. 238, 8221. *S. viridis;* 9421. *K. coccinea;* 9436. *S. viridis;* 9457. *I. majus;* 11084. *K. longepedunculata.*
Singh, S. 2. *S. grandiflora.*
Small, J. K., & al. 11209. *I. floridanum.*
Smith, H. 1964. *S. sphenanthera;* 2031. *S. sphaerandra typica;* 2366. *S. propinqua sinensis;* 5719. *S. chinensis;* 6577. *S. sphenanthera.*
Smith, J. J., & Rant. 408. *S. elongata.*
Soulié, J. A. 453. *S. lancifolia.*
Steenis, C. G. G. J. van. 6317. *I. sumatranum.*
Stengnell, E. J. 13956. *K. scandens.*
Steward, A. N. 1031. *S. viridis;* 2712, 4637. *I. lanceolatum.*
—— & H. C. Cheo. 537. *I. verum;* 989. *K. longepedunculata.*
——, C. Y. Chiao, & H. C. Cheo. 132. *S. Henryi typica;* 516. *I. majus;* 840. *K. heteroclita.*
Strachey, R., & J. E. Winterbottom. 1 (or 103). *S. grandiflora;* 2. *S. propinqua typica.*
Symington, C. F. 24243. *I. tenuifolium obovatum.*
Taam, Y. W. 546. *I. Tsangii;* 684. *K. coccinea;* 982. *I. Dunnianum.*
Takeda, H. 10. *S. chinensis;* 208. *I. anisatum;* 209. *S. chinensis.*
Takenouchi, M. 1074. *I. anisatum.*
Tanaka, T. 183. *I. anisatum;* 294. *S. chinensis.*
Tang, S. G. 6795. *K. longepedunculata.*
Tang, T. 972. *S. chinensis.*
—— & W. Y. Hsia. 126. *I. lanceolatum.*
Taquet, T. 838, 839. *I. anisatum;* 940. *S. repanda;* 2592, 2593. *K. japonica;* 2594. *I. anisatum.*
Tén, S. 160. *I. Simonsii;* 296. *S. propinqua intermedia;* 333, 362. *I. Simonsii;* 391, 540. *S. propinqua intermedia.*
Teng, S. W. 90255. *S. viridis;* 90454. *K. longepedunculata;* 90618. *S. Henryi typica;* 90658. *I. majus.*
Thwaites, G. H. K. 1028. *K. heteroclita.*
To, K. P., W. T. Tsang, & U. K. Tsang. 533. *S. viridis.*
Topping, D. L. 2090, 2107, 2496. *S. chinensis.*
Tracy, S. M. 5150. *I. floridanum.*
Tsai, H. T. 50458. *S. chinensis;* 50888. *S. sphenanthera;* 51168. *S. neglecta;* 51754. *I. Tsaii;* 52514. *I. majus;* 52919, 53052. *S. neglecta;* 53321. *S. Henryi yunnanensis;* 53549. *S. propinqua sinensis;* 53742, 54053. *S. neglecta;* 54643. *S. propinqua intermedia;* 55089. *I. majus;* 55101. *S. Henryi yunnanensis;* 55161. *S. micrantha;* 55188, 55192. *S. Henryi yunnanensis;* 55258, 55419. *K. coccinea;* 55493. *S. micrantha;* 57088. *S. propinqua intermedia;* 57316, 57585A, 57594A, 57681, 57875. *S. neglecta;* 57914, 57985. *S. rubriflora;* 58342A. *I. Simonsii;* 59522. *S. neglecta;* 59793. *S. sphaerandra typica;* 59827, 59926. *S. neglecta;* 59950. *S. sphaerandra typica;* 60058. *S. Henryi yunnanensis;* 60090. *I. majus;* 60136. *S. micrantha;* 60191, 60230. *S. Henryi yunnanensis;* 60260. *I. majus;* 60440. *K. heteroclita;* 60462. *S. Henryi yunnanensis;* 60487. *K. heteroclita;* 60597, 60658. *S. Henryi yunnanensis;* 60847, 60946. *K. induta;* 60980. *I. majus;* 61106. *S. Henryi yunnanensis;* 61107. *K. heteroclita;* 61266. *K. coccinea;* 61333, 61426, 61481. *K. heteroclita;* 61561, 61689, 62241. *S. Henryi yunnanensis;* 63107. *S. neglecta.*

TSANG, W. T. 267, 324. *K. heteroclita;* 357. *K. oblongifolia;* 725. *K. coccinea;* 8736, 20099. *I. brevistylum;* 20129. *I. Dunnianum;* 20268, 20397. *I. Tsangii;* 20397A. *I. brevistylum;* 20617. *K. coccinea;* 20826. *K. longepedunculata;* 21423. *S. viridis;* 22042. *I. Dunnianum;* 22311. *K. coccinea;* 23516. *I. brevistylum;* 24278, 24425, 24815. *I. pachyphyllum;* 24898. *I. Dunnianum;* 24941. *I. Tsangii;* 25239, 25309. *K. coccinea;* 25476, 25703. *I. Dunnianum;* 26260. *I. brevistylum;* 26556, 26605, 26670. *I. verum;* 27641, 27693. *S. viridis;* 27711. *K. coccinea;* 28783. *S. viridis;* 28867, 28921, 29159, 30029. *K. coccinea.*

—— & K. C. WONG. 2491. *K. heteroclita;* 14522. *I. brevistylum.*

TSIANG, Y. 965. *K. longepedunculata;* 1404. *K. heteroclita;* 4219. *I. Dunnianum;* 5152, 5673. *S. Henryi typica;* 5919. *I. Dunnianum;* 6007. *K. heteroclita;* 6137. *K. longepedunculata;* 6638. *K. heteroclita;* 7047, 7092, 8049. *I. majus;* 10011. *K. longepedunculata;* 10196. *I. lanceolatum;* 10362. *S. viridis;* 10611. *K. longepedunculata;* 10679. *S. viridis.*

TSO, C. L. 20231. *I. brevistylum;* 20374. *S. viridis;* 20393. *K. coccinea;* 20530. *S. Henryi longipes;* 20568. *I. majus;* 20679. *S. Henryi longipes;* 20740, 20811, 20847. *K. coccinea.*

TSOONG, K. K. 3432. *S. viridis;* 3530. *S. propinqua sinensis.*

TSOONG, T. S. [Z. S. CHUNG]. 81625, 81631. *I. majus;* 81750, 81933. *K. coccinea;* 82002. *S. viridis;* 82025, 83457. *I. majus;* 83594. *S. Henryi typica.*

TSUI, T. M. 825. *S. viridis.*

TUTCHER, W. J. 4661. *I. leiophyllum;* 10911. *I. Dunnianum.*

UNO, K. 4202. *K. japonica;* 19902. *S. chinensis.*

VANOVERBERGH, M. 1048, 3353. *I. philippinense.*

WALLICH, N. 4985. *S. grandiflora;* 4985c. *S. neglecta;* 4986. *S. propinqua typica;* 4987. *K. heteroclita;* 4987B. *S. propinqua intermedia.*

WANG, C. 34536. *K. heteroclita;* 35032. *I. ternstroemioides;* 35490, 35509, 36015. *I. oligandrum;* 39210. *I. brevistylum;* 39219, 39320. *K. coccinea;* 39328. *S. Henryi marginalis;* 39370, 39481. *I. verum;* 39499. *I. pachyphyllum;* 40091. *I. verum;* 40122, 40132. *I. brevistylum;* 40305. *I. verum;* 40519. *K. coccinea.*

WANG, C. W. 61754. *S. chinensis;* 63163. *S. sphaerandra typica;* 63258. *S. sphaerandra pallida;* 63372. *S. lancifolia;* 63435. *S. neglecta;* 63440. *I. Simonsii;* 63549. *S. neglecta;* 63595. *S. lancifolia;* 63634. *S. neglecta;* 63735. *S. rubriflora;* 63997, 64121. *S. neglecta;* 64229. *S. propinqua intermedia;* 66733, 67419, 67421. *I. Simonsii;* 67622. *S. neglecta;* 67966. *S. rubriflora;* 68684. *S. neglecta;* 71297, 72496. *S. lancifolia;* 73145. *S. plena;* 73695, 73734. *I. micranthum;* 73810. *S. Henryi yunnanensis;* 73851. *I. micranthum;* 74223A. *S. neglecta;* 74356. *K. heteroclita;* 75326. *S. Henryi yunnanensis;* 75376. *I. modestum;* 76340. *S. plena;* 76484, 76601, 76756. *S. Henryi yunnanensis;* 76848. *I. micranthum;* 77282A. *K. heteroclita;* 77299. *S. neglecta;* 77377. *K. heteroclita;* 77996. *S. Henryi yunnanensis;* 78784. *S. plena;* 80745. *K. heteroclita.*

WANG, F. T. 20682, 20827. *S. sphenanthera;* 21001. *S. rubriflora;* 21043. *S. sphenanthera;* 22166, 22314. *S. propinqua sinensis;* 22845. *S. tomentella;* 23026. *S. sphenanthera;* 23052. *S. tomentella;* 23221. *S. Henryi typica;* 23258. *I. micranthum;* 23281. *S. pubescens pubinervis.*

WANG, H. 41426. *S. micrantha.*

WANG, T. H. (in HANDEL-MAZZETTI). 95. *S. sphenanthera;* 495. *I. lanceolatum;* 12126. *K. coccinea.*

WANG, Y. K. 2878. *K. coccinea;* 3200. *K. heteroclita.*

WARD, F. K. 335. *I. Simonsii;* 387. *I. Wardii;* 8009. *S. plena;* 8050. *I. Simonsii;* 8210, 8665. *S. rubriflora;* 9095. *I. Merrillianum;* 9173. *K. interior;* 9443. *S. neglecta;* 9460. *K. interior;* 9530, 9593. *S. rubriflora;* 10193. *I. Merrillianum.*

WARD, L. F. 2025. *I. floridanum.*

WATT, G. 6146. *I. Simonsii;* 6585. *I. manipurense.*

WEBSTER, J. 192. *S. chinensis.*

WIEGAND, K. M., & W. E. MANNING. 1222, 1223. *I. floridanum.*

WIGHT, R. 2478. *K. heteroclita.*

WILFORD, C. 1057. *S. chinensis.*

WILSON, E. H. 158. *S. pubescens typica;* 164, 164a. *S. glaucescens;* 179, 179a in part. *S. sphenanthera;* 179a in part. *S. glaucescens;* 245. *S. sphenanthera;* 263. *S. incarnata;* 313. *S. sphenanthera;* 318. *S. incarnata;* 431. *I. Henryi typicum;* 485. *S. propinqua sinensis;* 603. *I. Henryi typicum;* 675. *S. sphenanthera;* 682. *I. Henryi typicum;* 779, 866, 869, 869a. *S. sphenanthera;* 883. *S. glaucescens;* 897 in part. *S. sphenanthera;* 897 in part. *S. pubescens pubinervis;* 921, 921a, 921b. *S. rubriflora;* 1036. *S. sphenanthera;* 1070. *S. propinqua sinensis;* 1116. *K. polysperma;* 1268, 1268a. *S. lancifolia;* 1268b, 1304, 1565. *S. propinqua sinensis;* 1726. *S. viridis;* 1735, 1736, 1737. *K. longepedunculata;* 1968. *S. sphenanthera;* 2085. *S.*

incarnata; 2149. *K. longepedunculata;* 2234. *S. pubescens typica;* 2234a. *S. Henryi typica;* 2551. *S. pubescens pubinervis;* 2552. *S. lancifolia;* 2553, 2554. *S. sphenanthera;* 3085. *I. majus;* 3086, 3086A, 3087. *I. Henryi typicum;* 3134. *S. lancifolia;* 3135, 4289. *S. rubriflora;* 4574. *S. incarnata;* 4722. *S. Henryi typica;* 6061. *I. anisatum;* 6092. *K. japonica;* 6170, 6189. *I. anisatum;* 6203. *K. japonica;* 6924, 7346, 7390. *S. chinensis;* 7473. *S. repanda;* 7535. *S. chinensis;* 7744. *S. repanda;* 8110. *I. Masa-Ogatai;* 8479, 8665, 8701, 8860, 9065. *S. chinensis;* 9361. *K. japonica;* 9446. *S. repanda;* 9709. *K. Matsudai;* 9712. *I. arborescens;* 9826. *S. arisanensis;* 9930. *I. arborescens;* 10182. *I. philippinense;* 10238, 10301. *I. arborescens;* 10341. *I. anisatum;* 10497. *S. chinensis;* 10857. *I. philippinense;* 11044. *K. Matsudai.*

WRAY, L. 251. *I. Ridleyanum;* 1029. *I. tenuifolium angustifolium.*

WRIGHT, C. 3, 1844. *I. cubense.*

YATES, H. S. 1505, 2520. *K. heteroclita;* 2881. *K. scandens.*

YÜ, T. T. 334. *I. majus;* 844. *S. pubescens typica;* 850. *K. coccinea;* 864, 949. *S. rubriflora;* 1047. *S. lancifolia;* 1208, 1446. *I. Simonsii;* 1771. *S. lancifolia;* 5582. *S. sphaerandra typica;* 8307, 8511. *S. rubriflora;* 10075. *S. sphaerandra typica;* 10319, 10483. *S. rubriflora;* 11482, 13497, 14506, 15108. *S. sphaerandra typica;* 15976. *S. sphaerandra pallida;* 16093. *S. Henryi yunnanensis;* 16138. *K. interior;* 16148. *S. neglecta;* 16315. *S. propinqua intermedia;* 17320. *K. interior;* 17507. *I. Simonsii;* 17720. *I. micranthum;* 17763, 18069. *S. Henryi yunnanensis;* 19108, 19132. *S. neglecta;* 19138. *I. Simonsii;* 19439. *S. neglecta;* 20542. *K. interior;* 22054. *S. propinqua intermedia;* 23117. *I. Simonsii.*

ZOLLINGER, H. 426. *K. japonica.*

INDEX

Synonyms are printed in *italics*, new names in **bold-face** type.

Actinidia Miquelii, 208
polygama, 145
Adas china, 76
Adas manis, 76
Agali, 102
Akabana-sikimi, 56
Akar dama-dama, 200
Akar Dama Daura, 200
Akar damak-damak, 200
Akar Kapala Patong, 200
Akar tjalak, 200
Andakajâ, 181
Andor sidari, 200
Anís, 60
Anis étoilé, 7, 76
Anise, Star, 76
Anise-seed tree, Florida, 39
Anise-seed tree, Red-flowered, 39
Anise-seed tree, Small-flowered, 42
Anisum Indicum, 74
peregrinum, 29
philippinarum insularum, 6, 74
stellatum, 29
Areuj boeoet, 200
Areuj hoemboet, 200
Areuj hoenjoer boeoet, 200
Aröj hunjur buut, 148
Aröy Hungur-bu-ut, 200
Bac ngu vi tu, 139
Badian, 8
Badianier, 8
Badianifera, 7, 11
anisata, 29
cambodgiana, 46
floridana, 37
Griffithii, 53
major, 47
officinarum, 74
parviflora, 41
Bakau bukit, 57
Ballon, 102
Banauwan, 193
Banoi, 102
Bát-giác-huong, 76
Bay-star vine, 142
Belebar, 200
Belewar, 200
Binan-kadsura, 81, 181
Binan-so, 181
Bitokaan, 193
Bunga lawang, 76
Cadsura, 157
grandiflora, 100
japonica, 180
propinqua, 151
Canogon, 198
Chau-fan-tuen, 169
Chau-fan-tuen-tang, 130, 169
Chimgaddi, 102
Ching-pat-kok-shue, 65
Chôrukupuri, 30
Chôsen-gomishi, 139
Chuen-t'ou-tze, 115
Cosbaea, 80, 85, 157, 162
coccinea, 162, 166, 168, 169
Cymbostemon, 9, 15
parviflorus, 41
Dai hôi, 47, 76
Dai hôi nui, 47
Drimys, 9, 88
Winteri chilensis, 78
Embelia Valbrayi, 150, 153
Euptelea, 88
Eupteleaceae, 9
Euptéléacées, 9
Fan-pau-kwoh, 169
Fan-tuen-tang, 176
Fanna Skiba, 29
Skimmi, 29
Futó Kádsura, 158, 180, 181
Glochidion Cavalerici, 48, 49
Gordonia terminalis, 53
Hananoki, 30
Hanashiba, 30
Honje Buut, 200
Hosoba-shikimi, 34
Ho-t'ang, 130
Hsiao-hsüe-t'êng, 154
Hsueh-hu-têng, 154
Hung-fa-hoh-shue, 72
Hun-gun Bu-ut, 200
Hunyur buut, 200
Idesia polycarpa, 137
Ilicium micranthum, 71
Illiciaceae, 2, 6, **8**
Illiciaceae, 9, 10
Illiciacées, 8, 9
Illiciea (*Magnoliaceae* B.), 8
Illicieae (*Magnoliaceae* II.), 8
(*Magnoliaceae* III.), 8
(*Magnoliaceae* subfam.), 8
(*Magnoliaceae* subord.), 8
(*Magnoliaceae* trib.), 8, 9
(*Magnoliacées* ser.), 8
(*Paeoniaceae* trib. *Dilleniariae* c.), 8
(*Paeoniaceae* c. *Dillenieae*), 8
(*Ranunculaceae* B. *Dillenieae* a.), 8
genuinae (*Ranunculaceae* 3. *Magnolieae* b. *Illicieae* α.), 8
Illiciées (*Magnoliacées* trib.), 8

Illicicium Japonicum, 29, 31
Illicineae (*Magnoliaceae* trib. *Illicieae* sect.), 8
Illicioideae (*Magnoliaceae* III.), 8
(*Magnoliaceae* subfam.), 9
Illicium, 4, 9, **10**, 84, map, p. 12
sect. Badiana, 3, 13, **14**
sect. **Cymbostemon**, 3, 13, **15**
sect. *Euillicium*, 14
acudentata, 79
angustisepalum, 17, **36**; map, p. 31
anisatum, 7, 11, 14, 15, 16, **28**, map, p. 31
genuinum, 29
leucanthum, 33
religiosum, 29
rosea, 29, 31
anisatum, 32, 35, 41, 74
arborescens, 18, **56**, map, p. 55
oblongum, 33, 34
brevistylum, 18, **50**, 73, map, p. 55
burmanicum, 16, **20**, map, p. 25
burmanicum, 20
cambodgianum, 46
cambodianum, 18, **46**, 57, map, p. 45
cambodianum, 56, 60, 66, 67, 68, 70
crassifolia, 57, 66, 69, 70
tenuifolia, 68, 69, 70
cauliflorum, 18, **46**, 61, map, p. 45
Cavalerici, 48
cubense, 18, 42, **59**, map, p. 13
daibuense, 33, 34
Dunnianum, 18, 19, **71**, 73, map, p. 77
Ekmanii, 17, **42**, map, p. 13
evenium, 12, 78
Fargesii, 22, 23, 25, 64
floridanum, 17, **36**, 40, map, p. 38
Griffithii, 12, 18, **53**, map, p. 55
cambodianum, 46
yunnanense, 22
Griffithii, 43, 48, 54, 58
Grifithii, 53
Henryi, **62**, map, p. 50
Henryi **multistamineum**, 19, 24, **64**
typicum, 19, **63**, 64
Henryi, 43, 48, 61, 63, 64
japonicum fol. rubro-marg., 79
kinabaluense, 18, **61**, map, p. 45
lanceolatum, 17, **43**, fig., p. 52, map, p. 50
laurifolium, 78
leiophyllum, 18, **54**, 73, map, p. 55
leucanthum, 33, 34
Linnaei, 74
macranthum, 16, **21**, fig., p. 26, map, p. 25
maius, 47
majus, 18, 46, **47**, 73, map, p. 50
manipurense, 16, **27**, map, p. 25
Masa-Ogatai, 16, **32**, map, p. 31
Masa-Ogatai, 32
Merrillianum, 19, **67**, map, p. 77
mexicanum, 17, **39**, map, p. 13
micranthum, 20, **73**, fig., p. 52, map, p. 77
Illicium *micranthum*, 76
modestum, 18, **51**, map, p. 55
montanum, 33
munipurense, 27
occidentale, 79
oligandrum, 18, **60**, map, p. 50
oliganthum, 60
pachyphyllum, 19, **64**, 73, map, p. 50
parviflorum, 15, 17, 40, **42**, map, p. 38
parviflorum, 42, 59
parvifolium, 17, **44**, map, p. 45
peninsulare, 18, 47, **56**, 58, map, p. 45
Petelotii, 20, **76**, map, p. 77
philippinense, 17, **33**, fig., p. 26, map, pp. 31, 45
randaiense, 35
reticulatum, 78
religiosum, 14, 29, 74
Masa-Ogatai, 32
rosea, 29
variegatum, 78
Ridleyanum, 19, 58, **66**, map, p. 45
San-ki, 74
Silvestrii, 63
Simonsii, 16, **22**, 25, 64, fig., p. 26, map, p. 25
spathulatum, 48, 49
Stapfii, 19, 61, **65**, map, p. 45
sumatranum, 19, **70**, map, p. 45
szechuanensis, 22, 24, 25
Tashiroi, 17, **35**, map, p. 31
tenuifolium, 19, 58, **68**, map, p. 45
angustifolium, 69, **70**
obovatum, 69, **70**
tenuifolium, **69**
ternstroemioides, 18, **58**, fig., p. 52, map, p. 55
Tsaii, 16, **27**, map, p. 25
Tsangii, 19, **61**, 73, fig., p. 52, map, p. 50
variegatum, 78
verum, 6, 7, 20, 73, **74**, map, p. 77
Wangii, 73
Wardii, 16, **20**, map, p. 25
yunnanense, 22, 23, 25
Jankaroh, 69
Kadsura, 83, 84, 85, **156**, 159, map, p. 5
sect. **Cosbaea**, 4, 84, 86, 159, **162**, fig., p. 160, map, p. 161
sect. **Eukadsura**, 85, 91, 159, 162, **163**, fig., p. 160, map, p. 161
sect. **Sarcocarpon**, 85, 159, 162, **163**, fig., p. 160, map, p. 161
acuminata, 187
ananosma, 164, **171**, fig., p. 172, map, p. 174
angustifolia, 165, **177**, 181, map, p. 175
apoensis, 196
Blancoi, 208
borneensis, 166, **205**, fig., p. 206, map, p. 202
calophylla, 164, **171**, map, p. 174

Kadsura *cauliflora*, 199
Cavaleriei, 167, 169
celebica, 166, **202**, fig., p. 206, map, p. 202
Championi, 187
chinensis, 94, 136, 162, 166, 169
annamensis, 167, 169
Clemensiae, 166, **206**, map, p. 202
coccinea, 159, 162, 164, **166**, fig., p. 172, map, pp. 170, 174
discigera, 183
grandiflora, 80, 93, 100
hainanensis, 167, 169
heteroclita, 80, 81, 158, 165, 176, **187**, 196, map, pp. 174, 186, 191
heteroclita, 169, 178
induta, 164, **173**, 181, map, p. 175
interior, 165, **178**, 181, map, p. 175
japonica, 79, 80, 81, 158, 163, 165, 176, **179**, map, p. 182
variegata, 209
variegata, 209
japonica, 166, 175, 180, 183, 187
lanceolata, 166, **203**, map, p. 202
lanceolata, 187
longepedunculata, 165, **183**, fig., p. 177, map, p. 186
Macgregorii, 194
marmorata, 166, **196**, 208, fig., p. 206, map, p. 202
Matsudai, 165, **183**, map, p. 182
oblongifolia, 165, **175**, 181, fig., p. 177, map, p. 175
oblongifolia, 177
paucidenticulata, 165, 181, **193**, 195, map, p. 174
peltigera, 184, 188
philippinensis, 166, 181, **192**, 195, map, p. 174
polysperma, 166, 181, **192**, map, p. 186
propinqua, 80, 151
pubescens, 208
Roxburghiana, 80, 167, 169, 187
macrocarpa, 187
scandens, 80, 81, 149, 158, 164, 166, 196, **199**, map, p. 202
cauliflora, 199
cuspidata, 209
intermedia, 199
normalis, 199
scandens, 196, 203
sorsogonensis, 194
sulphurea, 196
ultima, 166, **207**, map, p. 202
verrucosa, 166, **195**, map, p. 202
Wallichii, 199
Wattii, 187
Wightiana, 158
Wightiana, 187
Kadsurées (*Magnoliacées* ser.), 82
Kadzura, 157
Kang-mari, 189
Kanogon, 198
Kepala patong, 200
Kerukol akar, 200
Koshiba, 30
Kotziafa, 139
Kotzialta, 139
Kwoh-shan-ling-kung, 169
Kwo-shan-lung-t'ang, 189
Lan-fan-t'ang, 176
Laurineae a. *Menispermeae* cc. *Schizandreae*, 81
Lemon-wood, 139
Liao-wei, 126
Ling-tao, 126
Liukiu-shikimi, 35
Lomabag, 198
Magnoliaceae B. *Illicica*, 8
II. *Illicieae*, 8
III. *Illicieae*, 8
subfam. *Illicieae*, 8
subord. *Illicieae*, 8
trib. *Illicieae*, 8, 9
trib. *Illicieae* sect. *Illicineae*, 8
III. *Illicioideae*, 8
subfam. *Illicioideae*, 9
subfam. *Schisandreae*, 82
II. *Schizandreae*, 82
IV. *Schizandreae*, 82
subfam. *Schizandreae*, 82
subord. *Schizandreae*, 82
trib. *Schizandreae*, 82
II. *Schizandroideae*, 82
subfam. *Schizandroideae*, 82
II. *Wintereae*, 8
subord. *Wintereae*, 8
trib. *Winterae*, 8
trib. *Winteriae*, 8
Magnoliacées ser. *Illicieae*, 8
trib. *Illiciées*, 8
ser. *Kadsurées*, 82
ser. *Schizandreae*, 82
ser. *Schizandrées*, 82
trib. *Schizandrées*, 82
trib. *Wintérées*, 8
Mata caballo, 40
Matsbouza, 139
Matsubusa, 144
Maximovitzia, 87
chinensis, 136
Maximowiczia, 80, 85, 87, 88, 94
amurensis, 94, 136
chinensis, 136
japonica, 136
sinensis, 136
Maximowitschia, 87
amurensis, 136
chinensis, 136
japonica, 136
Mayna, 80, 84

Menispermaceae trib. *Schizandraceae*, 82
subfam. *Schisandreae*, 82
trib. *Schizandreae*, 81
Menispermeae trib. *Spuriae*, 81
Menispermideae trib. *Schizandreae*, 81
Mi-ja-ngew, 189
Mu-kua-jang, 126
Nâm xôi, 189
Ng mee tse, 139
Ohmidja, 144
Okinawa-shikimi, 33
Ô-mi-dja, 139
Orenj Kadsura, 180, 181
Oushi Boadô, 139
Paeoniaceae d. *Annoneae, Schizandreae*, 82
trib. *Anonariae* d. *Schizandreae*, 82
trib. *Dilleniariae* c. *Illicieae*, 8
c. *Dillenieae, Illicieae*, 8
Pa-keh-hwei-hsiang, 49
Pa-kioh, 76
Pa-ko, 76
Pa-k'ou-wei-shu, 63
Panslowia, 157
Parugaek, 30
Patjetan, 148
Patjetan ojod, 148
Pat-kok-shue, 65
Pauslowia, 157
Pa-yüeh-cha, 126
Pen ts'ao, 139
Phytocrene Blancoi, 208
Polycarpa Maximowiczi, 137
Pulcheria, 157, 158
Pusumi, 181
Pusun, 181
Ranunculaceae B. *Dillenieae* a. *Illicieae*, 8
3. *Magnolieae* b. *Illicieae*, α. *Illicieae genuinae*, 8
Re pa, 169
Roal, 102
Ro po, 169
Sane-kadsura, 81, 181
Sáne Kádsura, 180
San-ki, 76
Sarcocarpon, 80, 83, 85, 157, 158, 163
scandens, 158, 164, 199
Sarcocarposa, 157
Sarcocarpum, 84, 157
scandens, 199
Sassafras, White, 42
Schisandra, 4, 79, 83, 84, 85, **86**, 159, map, p. 5
sect. Euschisandra, 3, 84, 89, 91, 92, **95**, fig., p. 89, map, p. 92
sect. Maximowiczia, 84, 89, 91, 92, **94**, fig., p. 89, map, p. 92
sect. **Pleiostema**, 4, 84, 86, 89, 91, 92, **93**, 159, fig., p. 89, map, p. 92
sect. Sphaerostema, 84, 88, 89, 91, 93, **95**, fig., p. 89, map, p. 92
arisanensis, 99, **131**, map, p. 126
Schisandra axillaris, 80, 96, 100, 121, **147**, 153, map, p. 122
bicolor, 100, **146**, map, p. 140
chinensis, 81, 94, 99, 126, **136**, fig., p. 138, map, p. 140
coccinea, 87, 169
coccinea, 95, 141
elongata, 80, 98, **120**, 208, map, p. 122
elongata, 122, 127
glabra, 79, 88, 95, 100, **141**, map, p. 143
glaucescens, 99, **123**, map, p. 117
glaucescens, 109
gracilis, 99, **132**, map, p. 134
grandiflora, 80, 93, 97, **100**, map, p. 102
cathayensis, 109
rubriflora, 103
grandiflora, 106, 110
Henryi, 98, **111**
longipes, 98, **115**, map, p. 113
marginalis, **115**, 147, map, p. 113
typica, **114**, map, p. 113
yunnanensis, 114, **116**, fig., p. 105, map, p. 113
Henryi, 114, 115
incarnata, 97, **106**, map, p. 108
lancifolia, 99, **133**, fig., p. 105, map, p. 134
micrantha, 99, **135**, map, p. 134
neglecta, 99, 121, 122, **127**, fig., p. 105, map, p. 102
nigra, 143
perulata, 98, **110**, fig., p. 105, map, p. 113
plena, 100, **154**, fig., p. 155, map, p. 152
propinqua, 80, 100, **149**
intermedia, 150, **152**, fig., p. 155, map, p. 152
sinensis, 151, **153**, fig., p. 155, map, p. 152
typica, 150, **151**, map, p. 102
propinqua, 151, 152, 154
pubescens, 98, 111, 112, **116**
pubinervis, 118, **119**, map, p. 117
typica, **118**, map, p. 117
pubescens, 118
repanda, 81, 100, 141, **143**, fig., p. 146, map, p. 140
rubriflora, 97, **102**, fig., p. 105, map, p. 108
rubriflora, 109
sphaerandra, 97, 98, **107**
pallida, **109**, map, p. 108
typica, **109**, fig., p. 105, map, p. 108
sphenanthera, 99, **124**, fig., p. 105, map, p. 126
sphenanthera, 129, 133
lancifolia, 133
longipes, 115
pubinervis, 119
tomentella, 98, **119**, map, p. 117
viridis, 99, **129**, 147, map, p. 126
Wilsoniana, 98, **122**, fig., p. 105, map, p. 117

Schisandraceae, 2, 79, **81**
Schisandreae (*Magnoliaceae* subfam.), 82
(*Menispermaceae* subfam.), 82
Schizandra, 83, 84, 86, 157
(*Euschizandra*), 95
sect. *Sphaerostemma*, 95
arisanensis, 131
axillaris, 148, 152, 183, 199, 207
chinensis, 124, 136
glabrata, 137
rubra, 103
rubriflora, 103
typica, 137
coccinea, 141
crassifolia, 167, 169, 187
discolor, 143
elongata, 120, 123, 127, 208
dentata, 187, 209
longissima, 114, 129
marmorata, 208
glaucescens, 123
grandiflora, 100, 102, 106, 109
cathayensis, 109
Hanceana, 167, 169
Henryi, 114
hypoglauca, 114
japonica, 124, 136, 180
marmorata, 196, 208
nigra, 143
ovalifolia, 199
propinqua, 127, 151, 152, 188
lincaris, 153
sinensis, 152, 153
pubescens, 118
pyrifolia, 148
rubriflora, 103
sphaerandra, 109
sphenanthera, 103, 124, 129
lancifolia, 133
pubinervis, 119
verrucosa, 195
vestita, 118
Schizandraceae, 81
(*Menispermaceae* trib.), 82
Schizandreae, 80, 81
(*Laurineae* a. *Menispermeae* cc.), 81
(*Magnoliaceae* II.), 82
(*Magnoliaceae* IV.), 82
(*Magnoliaceae* subfam.), 82
(*Magnoliaceae* subord.), 82
(*Magnoliaceae* trib.), 82
(*Magnoliacées* ser.), 82
(*Menispermaceae* trib.), 81
(*Menispermideae* trib.), 81
(*Paeoniaceae* d. *Annoneae*), 82
(*Paeoniaceae* trib. *Anonariae* d.), 82
Schizandrées, 82
(*Magnoliacées* ser.), 82
(*Magnoliacées* trib.), 82
Schizandriaceae, 80, 81, 83
Schizandroideae (*Magnoliaceae* II.), 82
(*Magnoliaceae* subfam.), 82
Schizostigma axillare, 148
Shan-bar-kok, 72
Shan-pat-kok-shue, 65, 72
Shikimi, 30
Shui-hu-têng, 154
Singoto, 102
Sirobanasikimi, 34
Skimmi, 11
Somo, vulgò Skimi, 7, 29
Sphaerostema, 80, 83, 85, 86, 88, 95
axillare, 96, 147, 152
elongatum, 96, 120, 127
grandiflorum, 100
japonicum, 136
marmoratum, 196
propinquum, 151
pyrifolium, 147, 149
Sphaerostemma, 84, 86
axillare, 147
Blumiana, 187
elongatum, 120
grandiflora, 100
japonica, 136
pirifolium, 148
denticulatum, 148
pyrifolium, 148
Spuriae (*Menispermeae* trib.), 81
Star anise, 7, 76
Stellandria, 79, 85, 86
glabra, 95, 141
Sternanis, 7, 76
Taai-ip-kwo-shan-lung-t'ang, 189
Taai-yeung-chau-fan-tuen, 169
Taai-yeung-kwo-shan-lung, 169
Ternstroemia **evenia, 78**
khasyana, 12, 53, 54
Scortechinii, 78
Tetracentraceae, 9
Tetracentracées, 9
Theiarbawm, 189
Tieh-ku-san, 115
T'ie-ku-san, 154
Tororo-kazura, 181
Trochostigma, 145
polygama, 145
repanda, 143, 145
volubilis, 145
Tubee-kura, 189
Tulipiferae, 8
Urajiro-matsubusa, 144
Ushibudo, 144
Uvaria heteroclita, 187
japonica, 79, 80, 158, 163, 180
pirifolia, 148
pyrifolia, 147
Wèra aroi, 200

Winteraceae, 8
Wintereae, 8
(*Magnoliaceae* II.), 8
(*Magnoliaceae* subord.), 8
(*Magnoliaceae* trib.), 8
Winterées (*Magnoliacées* trib.), 8
Winteriae (*Magnoliaceae* trib.), 8
Wu-wei-t'êng, 124
Wu-wei-tze, 126
Wu-wei-tzu, 81, 119, 139
Xunh-xe, 169
Ye-paat-kok, 51
Ye-pat-kok-shue, 72
Zingi fructus stellatus, 6, 74

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